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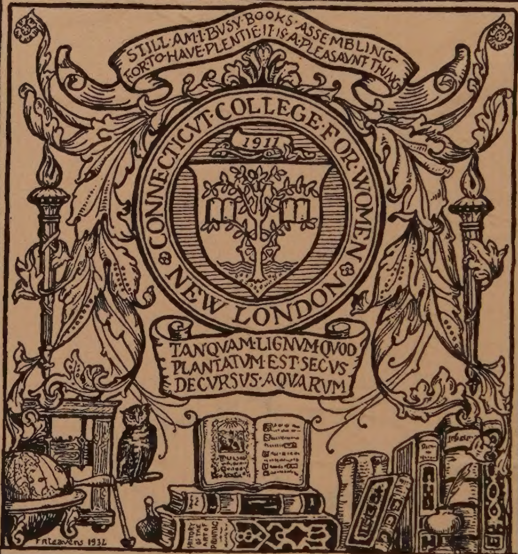
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FOREST RESOURCES OF THE WORLD

BY

RAPHAEL ZON

AND

WILLIAM N. SPARHAWK

FOREST ECONOMISTS, FOREST SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

With a Foreword by
GIFFORD PINCHOT

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FOREWORD

We are prone to call this the age of steel and of electricity, and to look upon wood as the foundation of an earlier and more primitive civilization. Yet, when one considers the part which wood plays in modern life—housing, transportation, manufactures, and particularly the dissemination of knowledge by means of books and newspapers, this is truly an Age of Wood. It is the tendency of modern times for the consumption of wood to increase throughout the world, and substitutes for wood merely create new uses for it. The problem to-day, and it is a world problem, is to make the available supplies keep pace with the increasing need for wood.

While the need for wood is increasing, the forest area is decreasing, as the result of land settlement, destruction by fire, and excessive cutting. Already, of the 25 or more countries of Europe, only four have a surplus of timber beyond what they need themselves. As the timber shortages of the different countries develop, it is becoming more urgent for the world to know where its future timber supplies will come from.

International organizations, such as the International Institute of Agriculture at Rome, are maintained for the collection of world agricultural statistics. Fairly accurate statistics of the world's mineral resources are also available. Forest resources, however, although basic for the industrial development of nations, are known least of all. There is no international organization for the systematic collection of forest statistics. Even the term "forest land" is not clearly defined; and there are no universally adopted units of measure for either standing or cut timber.

Our own forest resources are being depleted. Our high-grade hardwoods are almost exhausted, and manufacturers are looking to the tropics and elsewhere for foreign sources of supply. The tropical forests contain valuable timber, yet data regarding the kinds and qualities are not readily available. The last great bodies of softwood—those on the Pacific Coast—will soon be gone. Lumbermen of this and other countries are thinking seriously of getting timber from the great but little-known forests of Asiatic Russia. But can Russia meet the demand? Without accurate knowledge of the world's timber resources there can be no intelligent policy of forest conservation.

Great Britain in 1920 established an Imperial Forest Bureau to act as a clearing house for information on the forest resources of the Empire, and the French Government has recently made an investigation of the timber resources of its colonies. These are moves in the right direction, but more than the independent efforts of individual nations is required.

Theodore Roosevelt, in the last days of his presidency, took steps to call an international conference for the purpose of preparing an inventory of the natural resources of the world. Such a conference would be most timely now. It would not only bring together the known facts as to the extent and location of these resources, but could also outline general principles for their development and conservation. Forest resources naturally would be one of the principal subjects of consideration. Arrangements would be made for the uniform collection of statistics regarding forest areas, kinds and amounts of standing and growing timber, and production, consumption, and trade in forest products.

Such a conference would be particularly valuable at the time when a great part of the world is out of adjustment, after an exhausting war, and is eagerly seeking means of creating the new economic relationships which are essential for its normal development. Access to raw materials on equal terms for all countries is one of the fundamental needs if peace is to be preserved and economic rivalries kept within bounds. An inventory of the natural resources of the world is indispensable for the formulation of any international policy for developing them for the benefit both of the world at large and of the individual nations within whose boundaries they lie.

It is for this reason that this book should command the attention of economists and foresters throughout the world. So far as I know, it is the first attempt at a comprehensive inventory of the forests of the world. In my judgment, it is a most timely and valuable contribution to our knowledge of the world's sources of raw materials.

Mr. Zon is my old and valued friend. He is also, and has been for many years, my adviser and guide in the multitude of critical and intricate forest questions I have had to meet. Again and again I have relied upon his judgment with the happiest results. There is no higher authority in forestry in America.

"The Forest Resources of the World" brings together in a critical way the available information, and provides a solid foundation upon which to build, through future international cooperation, an organization for the continuous collection of complete forest statistics. What gives particular interest to the book is the fact that the forests are treated not merely as available exploitable materials, but as a living, renewable resource, not to be destroyed by use, but to be regrown, perpetuated, and improved.

Hitherto most of the discussions of the forest resources of the world have been confined principally to the better-known forests of temperate regions. The vast undeveloped tropical forests were practically ignored.

Now for the first time, in my judgment, these forests are considered in their proper perspective in the general forest situation. As a guide to the forest resources of the nations and the world, as an analysis of the factors affecting the development of forest policies, and as a record of the progress of forest conservation in different countries, this book will have unique value to economists, administrators, foresters, exporters, importers, and users of forest products.

GIFFORD PINCHOT

MILFORD, PENNSYLVANIA,
November, 1922.

INTRODUCTION

"Je ne propose rien, je ne suppose rien, j'expose."

Many difficulties are encountered in any attempt to take an accurate inventory of the forest resources of the world. Statistics of exports and imports of forest products of course are available as a part of the general organized collection of trade statistics. For many of the countries there are available also fairly accurate figures as to the amount of timber cut annually, but statistics of forest areas and of growth and consumption of timber do not exist in the true sense of the word. As a matter of fact, for a large portion of the world no forest surveys have yet been made, and many forest regions have not even been explored. Of the Siberian forests, for instance, only one-fifth of those belonging to the state have been explored, while for the rest only the most vague estimates exist. Even the term "forest land" is not uniformly defined. In some countries the estimates of forest land include chaparral, true savannas, and other land covered with small or scattered trees, while in others the estimates include only dense forests of commercial timber. Forest land, in this work, is understood to mean land covered with woody growth of economic importance. The gross areas of forest land as given, however, are seldom occupied by an unbroken forest cover; as a rule they are interrupted by many lakes, open swamps, meadows, burns, and mountain tops above timber line. Within the forest area of each country there is a larger or smaller proportion of such unproductive land. Moreover, in many regions, forests which furnish only firewood, fence posts, and small material required by the local population, are of great economic importance, even though they do not yield saw-timber in commercial quantities. For the world as a whole, probably only from two-thirds to three-fourths of all the land classified as forest land is capable of producing saw-timber. The growth figures, particularly, are speculative, being based for the most part on measurements on limited areas. The figures given for forest areas, growth, and consumption, therefore, must not be considered in the same light as statistical data regularly collected, but merely as the best estimates available. These figures, however, while they can not lay claim to great accuracy, do reflect the present status of our knowledge of the forest resources of the world.

In describing the forests, the authors have endeavored to give an idea of the kinds of trees which compose them, using such common general terms as conifers or softwoods, temperate hardwoods, and tropical hardwoods. In the northern countries the term "conifers" brings immediately to the mind of the reader such species as the pines, firs, spruces, larches, cypresses, and junipers, the botanical identity of which is pretty well established. The same is true to a lesser degree of the more important temperate hardwoods, such as oak, birch, beech, maple, ash, walnut, and sycamore. These trees are well known without further botanical identification. In attempting to describe the less known forests of the tropical regions and those of the temperate regions of the Southern Hemisphere, it was necessary in many cases to make use of the botanical names. This is especially the case with the tropical hardwoods, where a common name often includes not only several different species, but even different genera and families. The botanical identity of many of these species is not fully established. The authors in most cases followed the nomenclature used by the various authorities consulted, without attempting critical determination as to their correctness. Any systematist, therefore, may find many flaws in the names used, without starting dispute with the authors. If it had been possible, they would have preferred to dispense with the botanical names altogether.

The many different units in which the amount of standing timber is estimated present further difficulties in securing comparable figures. In some countries like North America, Australia, and several English colonies, the superficial measure, the superficial foot, or board foot, is the principal unit of measure. In others, the cubic meter, cubic foot or other cubic measure is used. While the conversion of cubic feet into cubic meters is a simple enough matter, the conversion of superficial feet into cubic measure, and vice versa, presents many pitfalls. The relation between superficial feet and cubic feet varies, of course, with the size of the timber, the degree of utilization, and the form of the product. A similar difficulty is experienced in converting tons, a very common unit of timber measurement, into cubic feet. The number of cubic feet to the ton, unless it is merely a shipping or capacity ton, varies, of course, with the weight of the wood. A ton of balsa wood represents a larger number of cubic feet than a ton of mahogany, while there are still fewer cubic feet in a ton of lignum vitae. In order to reduce all the figures to a comparable basis, the cubic foot has been used throughout. A conversion table is included, in case it may be desired to convert some of the figures to any other unit most commonly used in any particular country.

Estimates of standing timber in the different countries vary widely in character. In densely populated countries like France, Belgium, or Germany, where the utilization of wood is very close, even branchwood is included in the estimate. In some of the less developed countries, on the other hand, where economic conditions do not require closer utilization, the estimates take into account only logs 10 inches and more in upper diameter. Moreover, with variations in economic conditions there are corresponding variations in the criteria as to what constitute commercial species. In the United States, for instance, a few years ago the estimates of timber did not include such species as jack pine (*Pinus banksiana*) and aspen, while to-day many old estimates must be revised because of the fact that these species now have commercial value. Similarly, in many of the tropical forests where at present only a few species like mahoganies, ebonies or other cabinet woods or dyewoods are exploited, the rest, in many instances, are omitted from present calculations, even though they eventually may be of great commercial value. For instance, in the Dutch East Indies, so far estimates are available only for teak, while the rest of the forest is termed "wild forest," concerning which there is only very vague information.

In determining the forest resources of countries which manage their forests on a sustained yield basis, no attempt has been made in most cases to obtain figures which would show the stand in cubic feet. In such countries the cutting of timber is restricted to an amount not greater than the annual growth, and does not take into consideration the forest capital which produces this growth. In those countries the annual growth is used as the criterion of the present stand and the stand itself may be determined by a simple formula.* The forest capital itself, or what we call the present stand, is a constant quantity which is not to be disturbed. With improvement of the forest capital (more fully stocked forests or faster growing species), the annual growth increases and more timber is available for cutting. In North and South America, southeastern Europe, Africa, Australia, and most of Asia, where there are still large areas of mature timber and but little forest management in the strict sense of the word, the present stand in cubic feet is of special interest, as it shows how much virgin timber is available for cutting and affords a basis for judging the probable duration of the supply. For only a few countries, however, are there available estimates of the present stand of timber.

In order to make the results obtained for different countries comparable, an attempt was made in every case to show the forest area, the annual growth, and the annual cut, and from these three factors to make deductions as to the forest resources of the different countries. For each country the following topics are discussed: forest area; character and distribution of forest; character of ownership; annual growth; annual cut; exports and imports; domestic consumption; progress in forest conservation; and the probable future. Although the primary purpose of the book is to bring together information regarding the supplies and production of timber, some other forest products are discussed briefly.

In a work of this character the authors had to depend very largely

*Stand $= \text{annual growth} \times \text{area} \times \frac{\text{rotation}}{2}$.

on information already published. They have freely used the printed reports of the forest departments of the various countries, maps, and other official and unofficial reports and statistical data, but have attempted to use such material discriminately and critically. Wherever gaps existed, they used their own estimates, based upon comparison with other countries for which fairly reliable information was available. For whatever errors the work contains, and the authors have no illusions as to their bold undertaking, they must assume a large share of the responsibility.

The accomplishment of the task was made possible only by the cooperation of the Forest Service of the United States Department of Agriculture, in making available its resources and the official time of its members in performing the work. It is, therefore, in a sense, an official publication of the Forest Service. The work has been further greatly aided by the National Research Council, which as a part of its project on the collection of international forest statistics, arranged for its publication.

It is impossible for the authors to acknowledge individually their great indebtedness to their many colleagues in forestry work throughout the world. In the references accompanying the discussion of each country are indicated the principal sources used in preparing this work. Especial acknowledgment is due to many of their co-workers in the Forest Service for their help in overcoming many of the difficulties. The authors are under particularly heavy indebtedness to Alice M. Meynes, for preparing and checking the numerous tables and statistical material; to Winifred D. Whaley, for translation of much material from French, German, Spanish, and Italian sources; to Lilian T. Conway for reading over and editing the manuscript; and to Marie Simonson for her long and valuable assistance in carrying the work through its various stages. The forest maps used in the book for the most part are original maps not hitherto published. The credit for their preparation is almost entirely due to the staff of the Office of Drafting of the Forest Service, particularly to John M. Witherow, whose direction and advice were invaluable, and to Mary T. Walter, for her industrious search for material and compilation of many of the maps.

RAPHAEL ZON
WILLIAM N. SPARHAWK

WASHINGTON, D. C.
December, 1922

FOREST RESOURCES OF THE WORLD

CHAPTER I

THE GENERAL SITUATION

Under present conditions no civilized country is entirely independent economically of other countries. Even countries like the United States and Russia, which contain within their borders practically all the natural resources necessary to make them independent in every respect, are constantly interchanging their products with the rest of the world. A country deprived of certain natural resources may still be prosperous and progressive, because it is able to obtain all that it needs from other countries which have a surplus of these products. It is necessary to take into account the forest resources of all countries in order to determine the extent to which any given country can depend upon external resources in case of exhaustion of its own timber, or to determine the part which it plays or may play in supplying the needs of other countries for forest products.

But forests are also important in the life of every nation because of their influence on the water supply, on agriculture, and on the general welfare. It is now generally accepted that in order to guard a country against unfavorable changes, 30 per cent of its productive land area should be maintained under forest, leaving 60 per cent for crops, and 10 per cent for cities and villages. Only a few countries with an insular climate, as England and Holland, may with immunity against such changes reduce their forest areas beyond a certain limit. Ordinarily a country in which the forest area has been reduced to 20 per cent or less shows to a marked degree bad climatic conditions, with prolonged droughts, frosts, and alternating floods and low water. Spain with a forest area of only 14 per cent, Greece with 15 per cent, Italy with 18 per cent, are good examples of this. Furthermore, each country has always a certain amount of land which is unsuitable for agriculture and which, unless under forest, is idle, unproductive land—a burden upon the community.

There is still another reason why, in considering the forest resources of a country, it is important to study also the forests and economic conditions of other countries. There is a certain interrelationship between the extent and condition of natural resources and their use. History clearly shows that in countries with abundant natural resources and sparse population there is no thought of the future and all energy is directed toward the exploitation and reckless use of what nature has abundantly provided. The waste under such conditions is naturally very great and a more economical utilization does not pay. As the population increases and industry grows the demand for raw material of all kinds increases, and there is a gradual awakening of public opinion to the need of a more careful husbanding of natural resources. Practically all nations have traveled the same road. Some reach this point sooner than others, but every one is inevitably bound to face the same situation. Some young countries in North and South America, Africa, Asia, endowed with abundant natural resources, until lately were lagging somewhat behind. It therefore may be of advantage to those new countries to seek lessons for their future guidance in the experience of the older countries which have been benefited by proper care of their forests, waters, and soils.

THE GEOGRAPHIC DISTRIBUTION OF FORESTS

Although forests have exerted a great influence upon the development of human civilization from its beginning, our knowledge of the extent of the forests of the world is still very incomplete. The present forest area, in round figures, is about 7½ billion acres, which is 22 per cent of the land area exclusive of the polar regions. This is 4.35 acres per capita for the population of the world. The area of actually productive forest, however, is probably one-fourth less than this amount, or 5½ billion acres, which is 16 per cent of the land area, and 3.2 acres per capita.

In prehistoric times, and also, according to tradition and written record, in the earliest historic times, forests occupied a much larger proportion of the earth's surface. As a result of land clearing and the forest fires that followed in the wake of forest exploitation, much of the original forest has disappeared. With the exception, possibly, of China, the greatest change has taken place in Europe, where of a total land area of nearly 2½ billion acres, only one-third, or 774 million acres, remains in forest. Almost two-thirds of this, or about 500 million acres, is in European Russia and Finland, and only 275 million acres in the rest of Europe. In Great Britain 95 per cent of the original forest is gone. In France, Spain, Belgium, Italy, and Greece, from 80 to 90 per cent of the original forest has been destroyed; while Sweden and Finland are the only countries with half of their forests left. In the United States of North America the original forest has shrunk more than 40 per cent in the course of three centuries. Large areas of forest have been cleared in the more populous regions of South America and Africa, and even in the less developed regions the process is going on slowly but steadily.

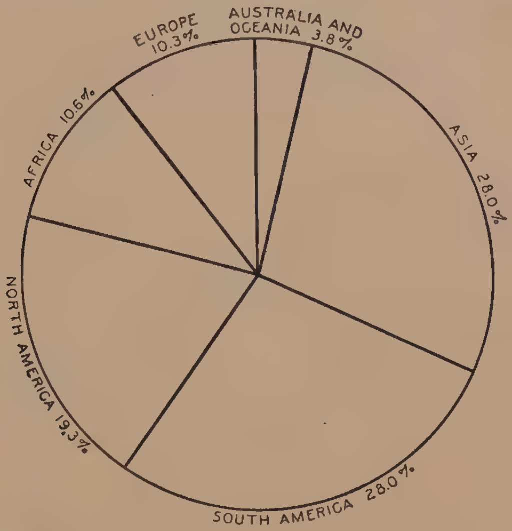


FIG. 1.—Division of the forest area of the world among the continents.

In Table 1 and Fig. 1 the six grand divisions of the earth's surface are compared with respect to the extent of their forests.

At present, Asia (including the East Indies) and South America have the largest areas of forest land, with more than two billion acres each.

TABLE 1.—COMPARISON OF FORESTS IN GRAND DIVISIONS OF EARTH

Continent	Forest area	Ratio of forest area to world's forest area	Ratio of forest to total area of continent	Forest area per 100 inhabitants
	Million acres	*Per cent*	*Per cent*	*Acres*
Asia	2,096	28.0	21.6	240
South America	2,093	28.0	44.0	3,245
North America	1,444	19.3	26.8	998
Africa	797	10.6	10.7	560
Europe	774	10.3	31.1	170
Australia and Oceania	283	3.8	15.1	3,470
Total	7,487	100.0	22.5	435

South America has a much smaller land area and population than Asia, so that its ratio of forest to total area is twice as great as Asia's and its forest area per capita more than thirteen times as great. Australia and Oceania, with the lowest percentage of forest except Africa and the smallest total forest area, has the most forest per capita, nearly thirty-five acres. Europe and Africa have approximately equal areas of forest; Europe, however, in spite of its denser population, is still nearly one-third covered with forest, or relatively three times as well wooded as Africa, while it has the least forest per inhabitant of any of the continents, only 1.7 acres. Although the forest area of North America is nearly twice

TABLE 2.—FOREST AREAS IN EUROPE

Country	Forest area	Ratio of forest to total land area	Forest area per 100 inhabitants
	Acres	*Per cent*	*Acres*
Austria	7,600,000	37.7	120
Belgium	1,321,240	18.2	20
Bulgaria	7,515,420	28.0	140
Czechoslovakia	12,354,000	34.3	90
Denmark	872,000	8.2	30
Esthonia	1,964,950	13.3	110
Finland	49,410,000	60.0	1,470
France	24,420,150	18.4	60
Alsace-Lorraine	1,088,270	30.3	60
Germany	30,905,840	23.8	50
Great Britain and Ireland	3,315,200	4.3	10
Greece	4,446,000	15.0	90
Hungary	3,148,000	14.0	40
Italy	14,252,000	18.1	40
Jugo-slavia	17,258,000	25.2	120
Latvia	3,039,550	19.4	120
Lithuania	4,466,500	19.1	100
Luxemburg	197,600	30.9	70
Netherlands	644,480	8.0	10
Norway	17,037,570	21.4	650
Poland	21,881,140	22.8	90
Portugal	5,000,000	22.0	80
Rumania	21,758,000	27.8	120
Russia	440,000,000	38.7	440
European Caucasus	5,473,500	10.0	100
Spain	16,886,350	13.9	80
Sweden	55,550,000	54.8	960
Switzerland	2,320,000	22.7	60
Total	774,118,460	31.1	170

that of Europe, it covers a smaller proportion of the continent, or only about one-fourth. There are ten acres of forest per inhabitant, or six times as much as in Europe. These wide differences between the several continents are due, of course, to a number of factors, the most important of which are topography, climate, and the attitude of the various peoples toward their forests.

The extent of forests in the individual countries, together with the ratios of forest to total land surface of each country and the relation between forest areas and population, are shown in Tables 2 to 7.

In Europe forests occupy 31 per cent of the land area. Russia, Sweden, and Finland have the most extensive forests, while Luxemburg, Netherlands, and Denmark have the least. Finland has the largest area of forest per capita, nearly 15 acres, followed by Sweden with 9.6, Norway with 6.5, and Russia with 4.4 acres. As for the percentage of land under forest, Finland again is in the lead, followed by Sweden and Russia. Finland, therefore, may be considered the most heavily wooded country

TABLE 3.—FOREST AREAS IN ASIA

Country	Forest area	Ratio of forest to total land area	Forest area per 100 inhabitants
	Acres	*Per cent*	*Acres*
Afghanistan	2,352,000	1.5	40
Arabia	1,150,000	1.5	20
British East Indies—total	40,504,000	82.2	4,550
North Borneo	19,000,000	95.8	7,360
Sarawak	21,504,000	80.0	3,580
Ceylon	13,031,040	79.9	280
China—total	190,000,000	6.9	60
China Proper	120,000,000	12.2	40
Chinese Turkestan	...	...	...
Manchuria	64,800,000	27.8	760
Mongolia	...	...	...
Tibet	4,000,000	1.3	60
Dutch East Indies—total	154,339,000	41.4	330
Celebes	12,330,000	26.7	410
Dutch Borneo	103,506,000	80.0	6,900
Java and Madura	7,163,000	22.1	20
Sumatra	28,500,000	25.0	570
All others	2,840,000	5.5	90

TABLE 3.—FOREST AREAS IN ASIA—*Continued*

Country	Forest area	Ratio of forest to total land area	Forest area per 100 inhabitants
	Acres	*Per cent*	*Acres*
French Indo-China—total	62,000,000	33.4	360
Annam	14,820,000	44.5	240
Cambodia	9,880,000	23.8	660
Cochin-China	5,186,000	36.8	170
Laos	23,469,000	34.9	4,270
Tongking	8,645,000	29.4	140
India—total	260,139,520	22.7	80
British	215,339,520	31.1	90
Native States	44,800,000	9.9	60
Japan—total	90,484,640	53.3	120
Japan Proper	46,602,180	47.9	80
Chosen	29,375,400	53.5	180
Formosa	7,156,780	79.2	200
Japanese Saghalien	7,350,280	85.9	9,800
Malay Peninsula—total	22,570,240	67.2	750
Malay States—Federated	13,440,000	76.4	1,050
Unfederated	8,960,000	59.6	1,000
Straits Settlements	170,240	17.6	20
Mesopotamia	...	...	...
Palestine and Syria	770,000	1.7	20
Persia	32,000,000	8.0	320
Philippines	38,400,000	50.0	430
Russia (Asiatic)—total	1,136,153,150	29.3	3,970
Siberia	1,083,500,000	30.5	7,530
Trans-Caucasus	12,995,500	21.3	170
Turkestan	39,657,650	14.7	590
Siam	35,000,000	22.5	400
Turkey	17,121,000	13.4	170
Total	2,096,014,590	21.6	240

of Europe, and Sweden is second. Norway, although only 21.4 per cent of its area is forested, has a larger per capita area than Russia, 38.7 per cent of whose land is under forest. The proportion of land under forest is a better criterion of the forest wealth of a country than the area of forest per inhabitant, provided the quality of the timber is the same.

Although Norway has a larger area per capita than Russia, most of its forests are second growth of inferior quality. The forests of Russia, on the other hand, especially in the northern part, still consist largely of virgin timber, untouched by the axe. Of the European countries, Finland, Sweden, and Russia, in the order given, all of which are located in the northern part of the continent, must be considered the most richly supplied with forests. The percentages of total area in forest and the areas per capita gradually decrease in Europe from north to south.

TABLE 4.—FOREST AREAS IN NORTH AND CENTRAL AMERICA

Country	Forest area	Ratio of forest to total land area	Forest area per 100 inhabitants
	Acres	*Per cent*	*Acres*
Canada	596,746,000	25.0	8,230
Central America:			
British Honduras (Belize)	3,825,000	75.0	9,000
Costa Rica	9,000,000	75.2	1,940
Guatemala	20,000,000	65.0	900
Honduras	23,700,000	80.0	3,750
Nicaragua	22,400,000	70.7	3,030
Panama	12,400,000	60.0	2,750
Salvador	925,000	17.8	70
Mexico	74,100,000	15.1	480
Newfoundland and Labrador	6,400,000	23.8	2,630
United States	550,000,000	28.9	520
Alaska	95,000,000	25.0	172,700
West Indies:			
British West Indies:			
Bahamas	370,000	13.0	650
Barbados	Area insignificant		
Bermuda	1,500	12.1	7
Jamaica	850,000	30.0	95
Leeward Islands	102,500	22.4	70
Trinidad and Tobago	756,500	59.4	195
Windward Islands	78,500	34.0	45
Cuba	13,000,000	46.0	450
Dutch West Indies	13,000	5.0	20
French West Indies	82,500	11.7	20
Haiti	4,250,000	60.0	170
Porto Rico	441,500	20.1	30
Santo Domingo	9,500,000	77.0	1,000
Virgin Islands of the United States	15,000	18.0	60
Total	1,443,957,000	26.8	998

In Asia, including the East Indies, the forests occupy only 21.6 per cent of the land area, but the acreage per inhabitant is larger than in Europe. The contrast between forest wealth of the different countries is much greater than in Europe. While in British North Borneo nearly 96 per cent of all the land is under forest, and in the Malay Peninsula and Ceylon from 67 to 80 per cent of the land is forested, Afghanistan, Arabia, Tibet, Palestine, and Syria have only 1.5 per cent. Siberia has the largest forest area per capita, followed by Borneo, and Arabia, Palestine and Syria have the smallest. The percentage of land area in forest, greatest in the north and southeast, decreases toward the southwest of the continent. An interesting comparison is presented between Siberia, whose percentage of forest is only 30, with but 2.6 inhabitants to the square mile, and densely populated countries like British India, with over 200 people per square mile and 31 per cent of its surface covered with forest, or the Japanese Empire, which has 300 inhabitants per square mile, yet still retains 53 per cent of its land under forest. Even in Java, with a population density of about 700 to the square mile, the forests occupy 22 per cent of the area. It is evident that countries with very dense populations and consequent need for utilizing all possible agricultural land can still retain a large part of their surface under forest, if they use a reasonable amount of care to prevent forest devastation.

In North America, Canada has the largest forest area, but nearly half of it is comprised in the lightly forested lands of the far north, whose ultimate commercial value is to a large extent problematical, and whose timber-producing capacity is very low. A large part of the forest area given for Alaska also is this sort of land. The area given for the United States includes considerable more or less devastated forest land which is capable of bearing commercial forests, although they are not there now, as well as large areas of woodland in the western States, which yield firewood, fencing, and other material for local consumption. While the proportion of land under forest now is approximately the same for the United States and Canada, it was originally much greater in the United States, nearly one-half of whose commercial forest has been destroyed to make room for agricultural and industrial settlement. Only 15 per cent of Mexico is wooded, partly because of climatic conditions over a large part of the country which do not favor forest growth, and partly because of destruction of forests in certain regions during more than a thousand years by the fairly dense population. Most of the Central American countries and many of the West Indies, even though they have been fairly well populated for hundreds of years, have climates more favorable to forests, and are still well wooded.

South America has a greater proportion of its surface covered with forest than any other continent. This is the result of climatic conditions, together with the lack of population and of agricultural or industrial development in the forest regions, which have hardly begun to be exploited. As in the other continents, the forests are very unevenly distributed, being heaviest in the Guianas and the Amazon basin, in parts of southern Chile, and in the coast ranges of southeastern Brazil. All of these are regions of heavy rainfall. Southern Argentina, northern Chile, southern Peru, and western Bolivia, and certain interior regions of Brazil and Venezuela have very dry climates and are almost treeless. The three Guianas are the most densely forested countries and at the same time the most sparsely populated, while Uruguay has the densest population and the smallest proportion of forest. Brazil, which comprises almost half of the continent, was originally almost 60 per cent forested, but now its ratio of forest is approximately the same as that for South America as a whole, or about 45 per cent.

While most of the great tropical forests of South America have been very little exploited and are yet practically intact, the forests of the more temperate regions, which have long been inhabited by fairly dense populations, have been greatly reduced in area as well as in stand of timber. Such regions are central Chile, the mountain regions of Peru, Ecuador, and Colombia, and the plateau region of southeastern Brazil.

Africa has a smaller proportion of its surface under forest than either of the other five principal divisions, although it has a larger proportion

TABLE 5.—FOREST AREAS IN SOUTH AMERICA

Country	Forest area	Ratio of forest to total land area	Forest area per 100 inhabitants
	Acres	*Per cent*	*Acres*
Argentina	264,000,000	36.1	3,200
Bolivia	128,000,000	38.9	4,400
Brazil	1,000,000,000	47.5	3,280
British Guiana	49,780,000	86.9	15,950
Chile	29,900,000	16.1	770
Colombia	150,000,000	53.8	2,700
Dutch Guiana (Surinam)	26,500,000	90.0	29,000
Ecuador	57,600,000	76.0	2,880
French Guiana (Cayenne)	21,000,000	98.0	42,000
Paraguay	37,000,000	58.0	4,600
Peru	224,000,000	51.2	3,860
Uruguay	1,070,000	2.3	70
Venezuela	103,840,000	41.2	3,650
Total	2,092,690,000	44.0	3,245

than Australia alone. The forests are distributed very unevenly. The most densely wooded countries are in the equatorial region of central and western Africa, including Liberia, Ivory Coast, Gold Coast, Nigeria, Cameroon, and French and Belgian Congo. Rhodesia in southern Africa has a large area of wooded land, but the forest is much more open in character than that of the equatorial belt. The forests of Algeria, Tunisia, and Morocco, although they occupy only a small portion of the surface, are of considerable importance. Many parts of the continent, such as the desert regions of the Sahara, South Africa, and Somaliland, have no

TABLE 6.—FOREST AREAS IN AFRICA

Country	Forest area	Ratio of forest to total land area	Forest area per 100 inhabitants
	Acres	*Per cent*	*Acres*
Belgian Africa			
Belgian Congo	180,000,000	30.9	1,500
British Africa—total	349,371,000	15.7	670
Basutoland	....	....	....
Bechuanaland	....	....	....
British East Africa	3,264,000	2.1	120
British Somaliland	500,000	1.1	170
British West Africa:			
Gambia	130,000	5.0	65
Gold Coast and Ashanti	24,390,000	47.6	1,630
Nigeria (Northern, Southern, and Lagos)	139,776,000	65.0	800
Sierra Leone	218,000	1.0	16
Egypt and Anglo-Egyptian Sudan	7,000,000	0.8	40
Nyasaland	280,000	1.0	25
Rhodesia—Northern	111,744,000	60.0	12,560
Southern	58,560,000	60.0	7,000
Seychelles	5,000	5.0	20
Swaziland	1,088,000	25.0	1,090
Uganda	896,000	1.5	27
Union South Africa	1,511,000	0.5	25
Zanzibar	9,000	2.2	8
Former German Africa—total	45,940,000	7.7	400
Cameroon—British	8,960,000	45.2	1,210
French	26,040.000	25.4	1,450
German East Africa	9,600,000	3.9	120
German Southwest Africa	1,000,000	0.5	500
Togoland	340,000	1.6	30

TABLE 6.—FOREST AREAS IN AFRICA—*Continued*

Country	Forest area	Ratio of forest to total land area	Forest area per 100 inhabitants
	Acres	*Per cent*	*Acres*
French Africa—total	154,627,000	7.5	500
Algeria	7,500,000	5.0	130
Dahomey	2,770,000	10.5	310
French Congo	80,000,000	41.7	1,000
Guinea	3,200,000	5.0	180
Ivory Coast	30,000,000	37.5	1,920
Madagascar	23,500,000	16.1	660
Mauretania	....	....	....
Morocco	3,700,000	2.6	70
Sahara Territories	....	....	....
Senegal	950,000	2.0	70
Somaliland	....	....	....
Reunion	7,000	1.2	4
Tunisia	3,000,000	9.4	150
Independent States:			
Abyssinia	14,820,000	6.6	190
Liberia	16,000,000	62.5	800
Italian Africa—total	2,500,000	0.7	120
Eritrea	....	....	....
Italian Somaliland	....	....	....
Tripoli	2,500,000	1.0	250
Portuguese Africa—total	29,700,000	5.0	390
Angola (and Kabinda)	10,000,000	3.2	240
Portuguese East Africa	18,800,000	6.9	600
Portuguese Guinea	900,000	10.1	310
Spanish Africa—total	4,500,000	5.5	550
Morocco	....	....	....
Rio de Oro	....	....	....
Rio Muni	4,500,000	74.2	2,250
Total	797,458,000	10.7	560

forests and are practically treeless. Although some of the original forests have been destroyed, the present distribution of forests in Africa is almost entirely the result of climatic conditions, and has been less modified by human activities than in any other continent.

For Australia and Oceania together 15.1 per cent of the land is under forest, while of Australia alone only 5.8 per cent is forested. New Guinea with 80 per cent forested is the most heavily wooded island and has almost twice as much forest as all of Australia. Tasmania has the largest proportion of forest land in the Australian Commonwealth, and of the South Sea Islands, Samoa is the most densely wooded. Most of the forests of Australia are located along the northern and eastern coasts. The interior and the western and southern coasts, excepting a few forest

TABLE 7.—FOREST AREAS IN AUSTRALIA AND OCEANIA

Country	Forest area	Ratio of forest to total land area	Forest area per 100 inhabitants
	Acres	*Per cent*	*Acres*
Australian Commonwealth—total	90,291,500	5.8	1,760
New South Wales	11,000,000	5.6	550
Queensland	40,000,000	9.3	5,710
South Australia	3,800,000	1.6	850
Tasmania	11,000,000	64.7	5,270
Victoria	8,000,000	14.2	560
Western Australia	16,491,500	2.6	4,970
New Zealand	17,073,920	25.7	1,610
Oceania—total	176,093,300	71.9	8,880
New Guinea—total	160,020,000	80.0	17,780
British	82,196,000	80.0	16,440
Dutch	77,824,000	80.0	19,460
Melanesia:			
Bismarck Archipelago	6,400,000	50.0	3,400
New Caledonia	494,000	11.0	880
New Hebrides	359,460	11.0	710
Solomon Islands	5,440,000	50.0	3,920
All others	270,720	18.6	900
Micronesia:			
Guam	6,400	5.0	70
Hawaiian Islands	1,031,840	25.0	400
All others	....	....	....
Polynesia:			
Fiji	1,189,600	25.0	980
Samoa	483,840	70.0	1,240
Society Islands (Tahiti, Kaukura, and Faaiti)	101,920	25.0	550
All others	295,520	25.0	600
Total	283,458,720	15.1	3,470

"islands" at high elevations and a limited area in the extreme southwest, have practically no timber, as they are principally desert regions.

Grouping their colonies, protectorates and dependencies together with the mother countries, the forest areas may be arranged as shown in Fig. 2.

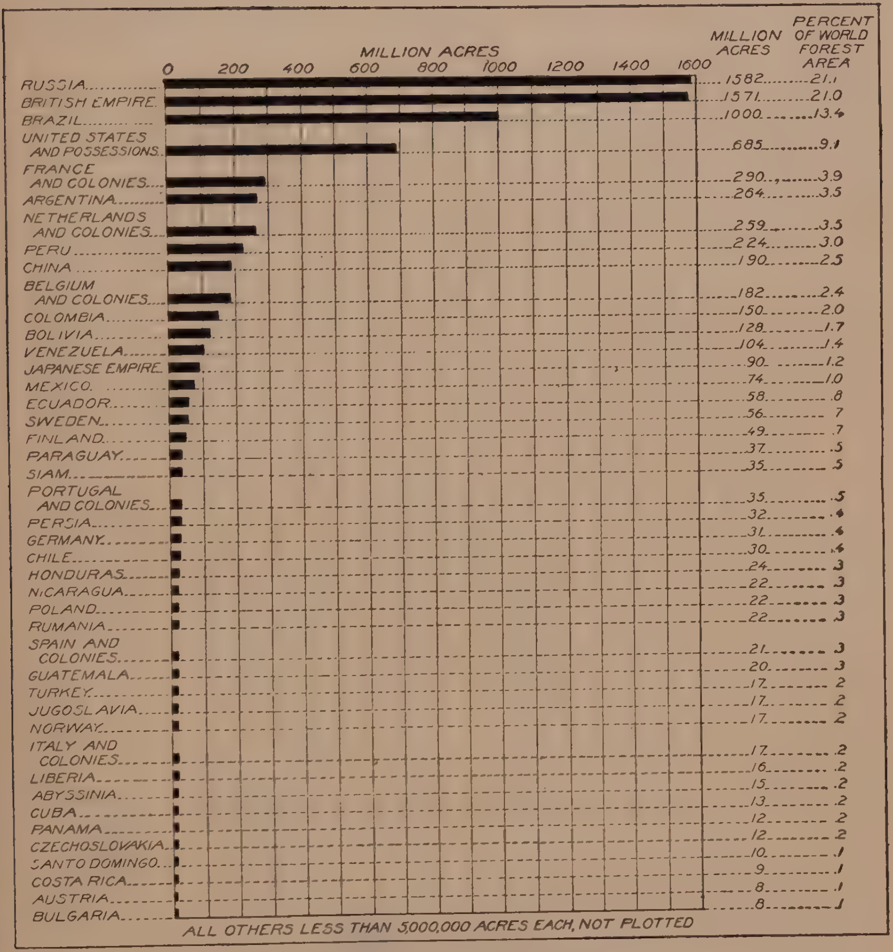


FIG. 2.—Political control of forests.

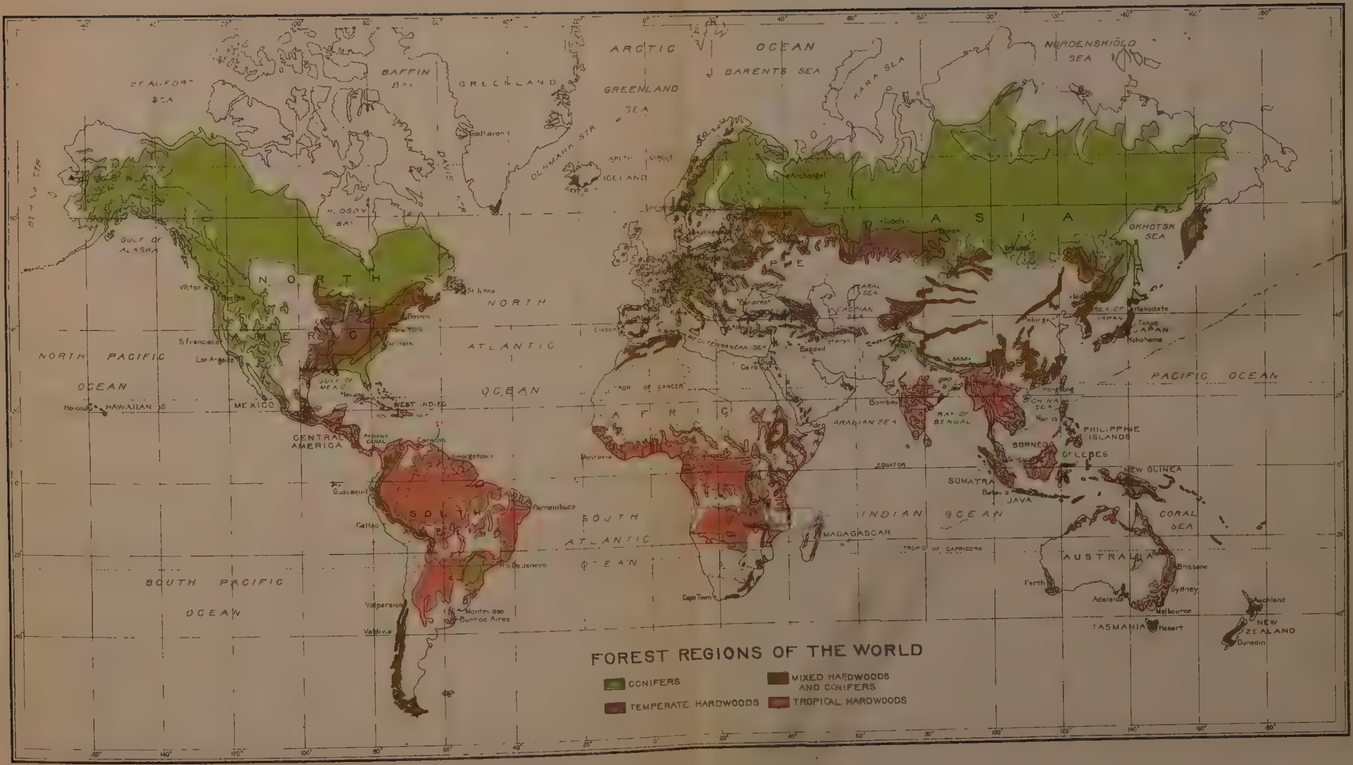
Russia has the most extensive forests, and the British Empire is a very close second. Each has more than one-fifth of the world's forests. Brazil and the United States come next, and these four countries together have nearly two-thirds of the forest lands of the world. The remaining one-third is divided among about 50 countries. It is interesting to note that Great Britain, France, Belgium, and the Netherlands, which together

TABLE 8.—CHARACTER OF FORESTS BY CONTINENTS

Country	Conifers		Temperate hardwoods		Tropical hardwoods	
	Millions of acres	Per cent of world total	Millions of acres	Per cent of world total	Millions of acres	Per cent of world total
Europe	579	21.9	195	16.2	....	0.0
Asia	889	33.6	572	47.5	635	17.5
Africa	7	0.3	17	1.4	773	21.2
Australia-Oceania	15	0.6	15	1.2	253	7.0
North America	1046	39.5	290	24.1	108	3.0
South America	109	4.1	115	9.6	1869	51.3
Total	2645	100.0	1204	100.0	3638	100.0

TABLE 9.—CHARACTER OF THE FOREST IN EUROPE

Country	Conifers		Temperate hardwoods		Mixed hardwoods and conifers	
	Area—acres	Per cent	Area—acres	Per cent	Area—acres	Per cent
Austria	4,560,000	60.0	1,520,000	20.0	1,520,000	20.0
Belgium	381,840	28.9	939,400	71.1	....	.....
Bulgaria	2,505,140	33.3	5,010,280	66.7	....	.....
Czechoslovakia	6,678,720	54.1	4,923,620	39.8	751,660	6.1
Denmark	435,100	49.9	387,400	44.4	49,500	5.7
Esthonia	1,277,220	65.0	687,730	35.0	....	.....
Finland	43,233,750	87.5	6,176,250	12.5	....	.....
France	4,884,030	20.0	19,536,120	80.0	....	.....
Alsace-Lorraine	362,390	33.3	725,880	66.7	....	.....
Germany	20,706,910	67.0	10,198,930	33.0	....	.....
Great Britain and Ireland	828,800	25.0	1,326,080	40.0	1,160,320	35.0
Greece	2,889,900	65.0	1,556,100	35.0	....	.....
Hungary	157,400	5.0	2,990,600	95.0	....	.....
Italy	584,330	4.1	12,684,280	89.0	983,390	6.9
Jugo-slavia	4,314,500	25.0	12,943,500	75.0	....	.....
Latvia	1,975,710	65.0	1,063,840	35.0	....	.....
Lithuania	3,126,550	70.0	1,339,950	30.0	....	.....
Luxemburg	24,700	12.5	172,900	87.5	....	.....
Netherlands	327,630	51.1	313,200	48.9	....	.....
Norway	12,778,180	75.0	4,259,390	25.0	....	.....
Poland	10,284,130	47.0	5,907,910	27.0	5,689,100	26.0
Portugal	2,400,000	48.0	2,600,000	52.0	....	.....
Rumania	6,244,550	28.7	13,859,840	63.7	1,653,610	7.6
Russia	387,200,000	88.0	52,800,000	12.0	....	.....
European Caucasus	1,204,170	22.0	4,269,330	78.0	....	.....
Spain	3,242,230	19.2	13,086,870	77.5	557,250	3.3
Sweden	48,606,250	87.5	6,943,750	12.5	....	.....
Switzerland	1,624,000	70.0	696,000	30.0	....	.....
Total	572,838,130	74.0	188,919,150	24.4	12,364,830	1.6



FOREST REGIONS OF THE WORLD

have but four-tenths of one per cent of the world's forests, control more than 30 per cent in their colonies and dependencies.

THE PRINCIPAL FOREST DIVISIONS: CONIFERS, TEMPERATE HARDWOODS, TROPICAL HARDWODS

The forests of the world may be classified broadly into three main groups: conifers, temperate hardwoods, and tropical hardwoods. While the distribution of the tropical and temperate hardwoods is determined more or less definitely by geographic factors, so that they seldom intermingle, the temperate hardwoods and conifers occupy many regions in common, and commingle to a large extent. There are extensive forests composed almost entirely of coniferous species, and others of hardwoods, yet over considerable areas there are mixed stands whose definite classification is difficult. In the figures in Table 8, such forests were evenly divided between conifers and hardwoods. Most of the mixed forests of the northern countries, as a result of the closer utilization of the conifers

TABLE 10.—CHARACTER OF THE FOREST IN ASIA

Country	Conifers		Temperate hardwoods		Tropical hardwoods	
	Area—acres	Per cent	Area—acres	Per cent	Area—acres	Per cent
Afghanistan	705,600	30.0	1,646,400	70.0		
Arabia					1,150,000	100.0
British East Indies					40,504,000	100.0
Ceylon					13,031,040	100.0
China	85,500,000	45.0	95,000,000	50.0	9,500,000	5.0
Dutch East Indies					154,339,000	100.0
French Indo-China	1,000,000	1.6			61,000,000	98.4
India—total	2,601,400	1.0	2,601,400	1.0	254,936,720	98.0
British	2,153,400	1.0	2,153,400	1.0	211,032,720	98.0
Native States	448,000	1.0	448,000	1.0	43,904,000	98.0
Japan	22,404,450	24.8	61,996,930	68.5	6,083,260	6.7
Malay Peninsula					22,570,240	100.0
Mesopotamia						
Palestine and Syria	350,000	45.5	300,000	38.9	120,000	15.6
Persia			32,000,000	100.0		
Philippines	1,280,000	3.3			37,120,000	96.7
Russia (Asiatic)—total	771,223,410	68.0	364,929,740	32.0		
Siberia	758,450,000	70.0	325,050,000	30.0		
Trans-Caucasus	2,859,000	22.0	10,136,500	78.0		
Turkestan	9,914,410	25.0	29,743,240	75.0		
Siam					35,000,000	100.0
Turkey	3,766,600	22.0	13,354,400	78.0		
Total	888,831,460	42.4	571,828,870	27.3	635,354,260	30.3

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and their greater susceptibility to fires and other damage, are gradually changing into hardwood forests. There would not be serious inaccuracy, therefore, in putting the entire area of temperate mixed forests into the hardwood group. For the world as a whole, coniferous forests occupy 35.4 per cent of the forest area, temperate hardwoods 16.0 per cent, and tropical hardwoods 48.6 per cent. Table 8 shows how the several types of forest are distributed among the six world divisions.

A most striking fact, and one of great economic significance, is that 95 per cent of the coniferous forests, upon which the world depends for its construction material, and 89 per cent of the temperate hardwood forests are in the north temperate zone. This zone, including Europe, most of Asia and North America, and the north coast of Africa, has almost three-fourths of the world's population and consumes an even greater share of the timber used in the world. The tropical hardwoods, of course, are confined to the tropical and adjacent subtropical regions of the earth,

TABLE 11.—CHARACTER OF THE FOREST IN NORTH AND CENTRAL AMERICA

Country	Conifers		Temperate hardwoods		Tropical hardwoods	
	Area—acres	Per cent	Area—acres	Per cent	Area—acres	Per cent
Canada	546,746,000	91.6	50,000,000	8.4	...	...
Central America:						
British Honduras	1,705,000	44.6	...	...	2,120,000	55.4
Costa Rica	1,350,000	15.0	...	...	7,650,000	85.0
Guatemala	2,000,000	10.0	...	...	18,000,000	90.0
Honduras	14,000,000	59.1	...	...	9,700,000	40.9
Nicaragua	6,400,000	27.5	...	...	16,000,000	72.5
Panama	...	...	...	...	12,400,000	100.0
Salvador	150,000	16.2	...	...	775,000	83.8
Mexico	35,000,000	47.2	25,000,000	33.7	14,100,000	19.1
Newfoundland and Labrador	6,000,000	93.8	400,000	6.2	...	...
United States	340,000,000	61.8	210,000,000	38.2	...	...
Alaska	90,000,000	94.7	5,000,000	5.3	...	...
West Indies:						
British West Indies—						
Bahamas	280,000	75.7	...	...	90,000	24.3
Barbados	...	...	...	...	...	...
Bermuda	1,200	80.0	...	...	300	20.0
Jamaica	...	...	...	...	850,000	100.0
Leeward Islands	...	...	...	...	102,500	100.0
Trinidad-Tobago	...	...	...	...	756,500	100.0
Windward Islands	...	...	...	...	78,500	100.0
Cuba	650,000	5.0	...	...	12,350,000	95.0
Dutch West Indies	...	...	...	...	13,000	100.0
French West Indies	...	...	...	...	82,500	100.0
Haiti	200,000	4.7	...	...	4,050,000	95.3
Porto Rico	...	...	...	...	441,500	100.0
Santo Domingo	1,350,000	14.2	...	...	8,150,000	85.8
Virgin Islands	...	...	...	...	15,000	100.0
Total	1,045,832,200	72.4	290,400,000	20.1	107,724,800	7.5

which have less than one-fourth of the population. The commercial exploitation of these forests has barely begun, and aside from supplying the limited needs of the local populations and furnishing small quantities of dyewoods and cabinet woods to other countries, they have hitherto contributed very little toward the world's requirements for timber.

The distribution of the three kinds of forest among the individual countries is shown in Tables 9 to 14.

TABLE 12.—CHARACTER OF THE FOREST IN SOUTH AMERICA

Country	Conifers		Temperate hardwoods		Tropical hardwoods	
	Area—acres	Per cent	Area—acres	Per cent	Area—acres	Per cent
Argentina	5,000,000	1.9	6,000,000	2.3	253,000,000	95.8
Bolivia	......	......	13,000,000	11.0	115,000,000	89.0
Brazil	100,000,000	10.0	......	......	900,000,000	90.0
British Guiana	......	......	......	......	49,780,000	100.0
Chile	3,500,000	11.7	26,400,000	88.3	......	......
Colombia	......	......	35,000,000	23.3	115,000,000	76.7
Dutch Guiana	......	......	......	......	26,500,000	100.0
Ecuador	......	......	10,600,000	18.4	47,000,000	81.6
French Guiana	......	......	......	......	21,000,000	100.0
Paraguay	......	......	......	......	37,000,000	100.0
Peru	......	......	24,000,000	10.7	200,000,000	89.3
Uruguay	......	......	......	......	1,070,000	100.0
Venezuela	......	......	......	......	103,840,000	100.0
Total	108,500,000	5.2	115,000,000	5.5	1,869,190,000	89.3

TABLE 13.—CHARACTER OF THE FOREST IN AFRICA

Country	Conifers		Temperate hardwoods		Tropical hardwoods	
	Area—acres	Per cent	Area—acres	Per cent	Area—acres	Per cent
Belgian Africa:						
Belgian Congo	......	......	......	......	180,000,000	100.0
British Africa—total	474,000	0.1	2,342,000	0.7	346,555,000	99.2
Basutoland	......	......	......	......	......	......
Bechuanaland	......	......	......	......	......	......
British East Africa	98,000	3.0	392,000	12.0	2,774,000	85.0
British Somaliland	......	......	......	......	500,000	100.0
British West Africa:						
Gambia	......	......	......	......	130,000	100.0
Gold Coast and Ashanti	......	......	......	......	24,390,000	100.0
Nigeria (Northern, Southern and Lagos)	......	......	......	......	139,776,000	100.0
Sierra Leone	......	......	......	......	218,000	100.0
Egypt and Anglo-Egyptian Sudan	......	......	......	......	7,000,000	100.0

Table 13.—Character of the Forest in Africa—*Continued*

Country	Conifers		Temperate hardwoods		Tropical hardwoods	
	Area—acres	Per cent	Area—acres	Per cent	Area—acres	Per cent
British Africa—Continued						
Nyasaland	2,000	0.8	....	......	278,000	99.2
Rhodesia—Northern	....	......	....	......	111,744,000	100.0
Southern	....	......	....	......	58,560,000	100.0
Seychelles	....	......	....	......	5,000	100.0
Swaziland	54,000	5.0	490,000	45.0	544,000	50.0
Uganda	18,000	2.0	251,000	28.0	627,000	70.0
Union South Africa	302,000	20.0	1,209,000	80.0	....	......
Zanzibar	....	......	....	......	9,000	100.0
Former German Africa—total	96,000	0.2	384,000	0.8	45,460,000	99.0
Cameroon—British	....	......	....	......	8,690,000	100.0
French	....	......	....	......	26,040,000	100.0
German East Africa	96,000	1.0	384,000	4.0	9,120,000	95.0
German Southwest Africa	....	......	....	......	1,000,000	100.0
Togoland	....	......	....	......	340,000	100.0
French Africa—total	5,791,000	3.8	8,409,000	5.4	140,420,000	90.8
Algeria	3,750,000	50.0	3,750,000	50.0	....	......
Dahomey	....	......	....	......	2,770,000	100.0
French Congo	....	......	....	......	80,000,000	100.0
Guinea	....	......	....	......	3,000,000	100.0
Ivory Coast	....	......	....	......	30,000,000	100.0
Madagascar	....	......	....	......	23,500,000	100.0
Mauretania	....	......	....	......	....	......
Morocco	1,591,000	43.0	2,109,000	57.0	....	......
Sahara Territories	....	......	....	......	....	......
Senegal	....	......	....	......	950,000	100.0
Somaliland	....	......	....	......	....	......
Reunion	....	......	....	......	7,000	100.0
Tunisia	450,000	15.0	2,550,000	85.0	....	......
Independent States:						
Abyssinia	444,600	3.0	2,519,400	17.0	11,856,000	80.0
Liberia	....	......	....	......	16,000,000	100.0
Italian Africa—total	375,000	15.0	2,125,000	85.0	....	......
Eritrea	....	......	....	......	....	......
Italian Somaliland	....	......	....	......	....	......
Tripoli	375,000	15.0	2,125,000	85.0	....	......
Portuguese Africa—total	188,000	0.6	1,692,000	5.7	27,820,000	93.7
Angola (and Kabinda)	....	......	....	......	10,000,000	100.0
Portuguese East Africa	188,000	1.0	1,692,000	9.0	16,920,000	90.0
Portuguese Guinea	....	......	....	......	900,000	100.0
Spanish Africa—total	....	......	....	......	4,500,000	100.0
Morocco	....	......	....	......	....	......
Rio de Oro	....	......	....	......	....	......
Rio Muni	....	......	....	......	4,500,000	100.0
Total	7,369,000	0.9	17,470,000	2.2	772,619,000	96.9

TABLE 14.—CHARACTER OF THE FOREST IN AUSTRALIA AND OCEANIA

Country	Conifers		Temperate hardwoods		Tropical hardwoods	
	Area—acres	Per cent	Area—acres	Per cent	Area—acres	Per cent
Australian Commonwealth:						
New South Wales	1,500,000	13.6			9,500,000	86.4
Queensland	1,000,000	2.5			39,000,000	97.5
South Australia					3,800,000	100.0
Tasmania	1,100,000	10.0	9,900,000	90.0		
Victoria					8,000,000	100.0
Western Australia					16,491,500	100.0
Total	3,600,000	4.0	9,900,000	11.0	76,791,500	85.0
New Zealand	11,610,270	68.0	5,463,650	32.0		
Oceania:						
New Guinea—						
British					82,196,000	100.0
Dutch					77,824,000	100.0
Total					160,020,000	100.0
Melanesia:						
Bismarck Archipelago					6,400,000	100.0
New Caledonia					494,000	100.0
New Hebrides					359,460	100.0
Solomon Islands					5,440,000	100.0
All others					270,720	100.0
Micronesia:						
Guam					6,400	100.0
Hawaiian Islands					1,031,840	100.0
All others						
Polynesia:						
Fiji					1,189,600	100.0
Samoa					483,840	100.0
Society Islands					101,920	100.0
All others					295,520	100.0
Total of Oceania					176,093,300	100.0
Grand total	15,210,270	5.4	15,363,650	5.4	252,884,800	89.2

PUBLIC AND PRIVATE OWNERSHIP OF FORESTS, AND FOREST CONSERVATION

The character of ownership undoubtedly has a profound influence upon the utilization and perpetuation of the forests of a country. It is a common belief that forests are better managed where they are mostly in public ownership, and with some exceptions this is true for the older European states. Several factors, however, affect the progress of forestry. In most new countries natural resources are abundant but population is sparse, financial resources limited, and the need is great for development of public works such as building of roads, railroads, and irrigation or drainage works, or for the building up of new industries and encouragement of immigration. In such cases there is a tendency at first to dispose

TABLE 15.—CHARACTER OF OWNERSHIP IN EUROPE

Country	Public forests[1]		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Austria	2,704,000	35.6	4,896,000	64.4	Before the war public forests well managed. Public control also over private forests which were considered protection forests.
Belgium	502,880	38.0	818,360	62.0	Strict regulation of public forests. No control over private timberlands except where of public importance.
Bulgaria	6,231,340	82.9	1,284,080	17.1	Good forest laws on the statutes but until recently ineffective. Regulation extends to both public and private forests.
Czechoslovakia	4,457,000	36.1	7,897,000	63.9	Strict regulation of public forests. Considerable control exercised over private timberlands.
Denmark	460,900	52.9	411,100	47.1	Both public and private forests well regulated.
Esthonia	168,200	8.6	1,796,750	91.4	Before the war public forests well managed. Control over private forests extended only to protection forests.
Finland	17,342,910	35.1	32,067,090	64.9	Strict regulation of public forests. Control extends also to cuttings on private timberlands; special provisions for the regulation of protection forests.

Table 15.—Character of Ownership in Europe—*Continued*

Country	Public forests[1]		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
France	8,438,050	34.5	15,982,100	65.5	Strict regulation of public forests. Control over private forests only when they are protection forests. Private forests well managed without public compulsion.
Alsace-Lorraine	871,900	80.1	216,370	19.9	
Germany	16,267,850	52.7	14,637,990	47.3	Strict regulation of public forests. In majority of States government control over private timberlands extends only to protection forests; in a few there is reasonable control over clearing and devastation. Private forests well managed without public compulsion.
Great Britain and Ireland	120,960	3.6	3,194,240	96.4	Fair management of public forests. No public control over private timberlands, which, however, are well cared for by their owners.
Greece	4,001,400	90.0	444,600	10.0	Theoretically both public and private forests under government supervision. The laws are ineffective.
Hungary	944,400	30.0	2,203,600	70.0	Before the war public forests under government supervision. Public control over private forests only in protection areas.

TABLE 15.—CHARACTER OF OWNERSHIP IN EUROPE—*Continued*

Country	Public forests[1]		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Italy..........	7,082,500	49.7	7,169,500	50.3	Government control of public forests. Control over private timberlands only in protection zones. Private forests fairly well cared for by their owners.
Jugo-slavia.....	11,493,830	66.6	5,764,170	33.4	Before the war public forests under government control. Control over private timberlands extended only to protection forests.
Latvia.........	915,700	30.1	2,123,850	69.9	Before the war public forests regulated. Public control of private timberlands only in case of protection forests.
Lithuania......	1,659,600	37.2	2,806,900	62.8	Before the war public forests regulated. Public control of private timberlands only in case of protection forests.
Luxemburg.....	79,040	40.0	118,560	60.0	Public forests strictly regulated. Public control over private timberlands confined to prevention of clearing and safeguarding forests in protection areas. Private forests well cared for by owners.

TABLE 15.—CHARACTER OF OWNERSHIP IN EUROPE—*Continued*

Country	Public forests[1]		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Netherlands....	196,290	30.6	444,540	69.4	Public forests regulated. Reasonable public control over private timberlands. Private timberlands well cared for by owners.
Norway........	3,577,890	21.0	13,459,680	79.0	Public forests regulated. Reasonable public control over cuttings on private timberlands. Private owners on the whole take fairly good care of their forests.
Poland.........	6,650,060	30.4	15,231,080	69.6	Before the war public forests regulated. Public control over private timberlands only in case of protection forests.
Portugal.......	86,890	1.7	4,913,110	98.3	Public forests properly protected and regulated. Public control over private forests when considered of public importance.
Rumania.......	11,053,060	50.8	10,704,940	49.2	Laws are on statute books for government regulation of all public forests. Private timberlands also are supposedly under public supervision where protection is of public importance. The laws are not fully enforced.

TABLE 15.—CHARACTER OF OWNERSHIP IN EUROPE—*Continued*

Country	Public forests[1]		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Russia[2]	245,282,700	66.8	122,008,300	33.2	Before the war public forests under government regulation; also public control over private lands declared protection forests.
European Caucasus	1,744,400	31.9	3,729,100	68.1	
Spain	11,886,350	70.4	5,000,000	29.6	Public forest lands under government supervision, also private lands located in "protection zones." No regulation of cutting on private forest lands.
Sweden	13,131,000	23.6	42,419,000	76.4	Public forests strictly regulated. Public control extends to cuttings on private timberlands. Private timberlands under forest management.
Switzerland	1,682,000	72.5	638,000	27.5	Public forests under strict government regulation. Public control also over private timberlands, both protection and all other forests. Private forests as a rule under forest management.
Total	379,033,100	54.0	322,380,010	46.0	

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[1] Public forests in this and succeeding tables include those belonging to states, municipalities, communes, religious and other semi-public corporations. For detailed data see the descriptions of the individual countries.

[2] Productive forest only.

of large areas of public lands or other valuable public resources for the purpose of stimulating or rewarding development. This has been the experience of many countries in North and South America, Africa, and elsewhere. Even when title to the land is retained, the resources are usually exploited in as wasteful a manner as those in private ownership. In most of the countries of Africa and South America, for instance, even in the colonies of the European nations which take good care of their own forests, the ownership of a large part of the timberlands by the crown or by the state has little effect upon their development and preservation.

Other factors to be taken into account are the political and financial stability of the governments and their ability to exert effectual control over the exploitation of the public forests as well as those in private ownership. With few exceptions, such control is possible only where it has the backing of public opinion founded upon an appreciation of the need for conservative handling of the natural resources. In Turkey, Bulgaria, and Greece, for instance, the proportion of forests in public ownership is larger than in France or Germany, yet they are in a deplorable condition, in some cases worse than those privately owned. On the other hand, in some countries the forests may be well managed, yet the area owned by the state may be comparatively small. The reason for this

Table 16.—Character of Ownership in Asia

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Afghanistan	....	......	....	......	No information. Probably no control over any forest.
Arabia	....	......	....	......	No information. Probably no control whatever.
British East Indies	40,504,000	100.0	....	......	Forest policy just in its inception.
Ceylon	12,926,080	99.2	104,960	0.8	Government control over all public forests. Law still lacks power over privately owned lands.
China	....	......	Large part ably in ownership	probpublic	Some educational and forestry propaganda work. No public supervision of forests.

TABLE 16.—CHARACTER OF OWNERSHIP IN ASIA—*Continued*

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Dutch East Indies (total)	138,905,100	90.0	15,433,900	10.0	The teak forests of Java are under careful government management. All other forests in Java and in the other islands do not receive much supervision.
Celebes	11,097,000	90.0	1,233,000	10.0	
Dutch Borneo	93,155,400	90.0	10,350,600	10.0	
Java & Madura	6,446,700	90.0	716,300	10.0	
Sumatra	25,650,000	90.0	2,850,000	10.0	
All others	2,556,000	90.0	284,000	10.0	
French Indo-China	62,000,000	100.0	...	...	The reserve forests are strictly regulated. For the remainder, all of which are public forests, there are only a few restrictions as to the cutting of certain kinds of trees.
India (total)	210,859,520	81.1	49,280,000	18.9	The state forests in British India proper and the Native States are under management of trained forest staffs. No public control over the rest.
British	166,059,520	77.1	49,280,000	22.9	
Native states	44,800,000	100.0	...	...	
Japan	29,042,480	62.3	17 559,700	37.7	Strict public control exists over both public and private forests.
Chosen, Formosa, and Saghalien	Data	not	available.		
Malay Peninsula (total)	21,930,240	97.2	640,000	2.8	Forest legislation exists with regard to the protection of forests and forest products. Forest management, however, is just beginning.
Malay States Federated	13,440,000	100.0	...	...	
Malay States Unfederated	8,320,000	92.9	640,000	7.1	
Straits Settlements	170,240	100.0	...	...	
Mesopotamia	...	...	...	...	No public control and no forest management.

TABLE 16.—CHARACTER OF OWNERSHIP IN ASIA—*Continued*

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Palestine and Syria	677,600	88.0	92,400	12.0	
Persia	32,000,000	100.0	....	......	No information available, but evidently no care of the forests, all of which are in public ownership.
Philippines	37,440,000	97.5	960,000	2.5	Competent government supervision is provided for the forests, nearly all of which are publicly owned. Forest management, however, is still in its infancy.
Russia (Asiatic) (total)	1,081,973,570	95.2	54,179,580	4.8	Before the war nominal government supervision existed over all state forests. In view, however, of the vastness of the forests and their low exploitation, such supervision was not very effective.
Siberia	1,037,600,000	95.8	45,900,000	4.2	
Trans-Caucasus	6,698,800	51.5	6,296,700	48.5	
Turkestan	37,674,770	95.0	1,982,880	5.0	
Siam	35,000,000	100.0	....	......	The forest department exercises fairly rigid control over the teak forests. Supervision is lax, however, with regard to all other forests.
Turkey	16,677,190	93.9	443,810	6.1	Theoretically all forests are under state supervision, but it is ineffective.
Total[1]	1,719,935,780	82.0	138,694,350	6.6	

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[1] Status unknown, 237,384,460 acres, or 11.4 per cent of the total area.

TABLE 17.—CHARACTER OF OWNERSHIP IN NORTH AND CENTRAL AMERICA

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Canada	556,746,240	93.3	40,000,000	6.7	150,000,000 acres of public forest dedicated to permanent timber production and under direct public supervision. Limited regulation of cutting on remaining public lands. No public control over private lands; small portion well managed by owners.
Central America:					
British Honduras (Belize)	1,570,000	40.0	2,255,000	60.0	No regulation for public or private forests.
Costa Rica	Much (possibly two-thirds) in public ownership.				Some regulation of both public and private forests.
Guatemala	Most of forest land is public.				No regulation of private forests. Good laws for public forests, but not known as to enforcement.
Honduras	Large part is publicly owned.				Little restriction except collection of license tax on public forests.
Nicaragua	Mostly in public ownership.				Little restriction on cutting.
Panama	Mostly in public ownership.				Some regulation of exploitation of public forests.
Salvador	Practically all private.				Strict public regulation of cutting in private forests.

TABLE 17.—CHARACTER OF OWNERSHIP IN NORTH AND CENTRAL AMERICA—*Continued*

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Mexico.........	A large part is public.				Public forests more or less protected. Private ones not, but may be under new law.
Newfoundland and Labrador.	Practically all public.				Mostly held under license by operators. Limited amount of protection.
United States[1]...	98,164,000	20.9	371,311,000	79.1	Almost all the public forest is in national or State forests, and is protected and managed for permanent timber production. Much of the private forest especially in the northeastern and western States is given some protection, but very little is managed as permanent resource. There are no legal restrictions on exploitation of private forests.
Alaska.......	All public.				20,580,000 acres under Forest Service regulation. No protection for rest.
West Indies:					
British West Indies:					
Bahamas...	320,000	86.5	50,000	14.5	Little regulation of crown lands or private lands.
Barbados...	All private.				No regulation.
Bermuda...	All private.				Handled conservatively.

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[1] Timber forest, not including piñon-juniper, mesquite, and other woodland.

TABLE 17.—CHARACTER OF OWNERSHIP IN NORTH AND CENTRAL AMERICA—*Continued*

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
W. I.—Contd.					
B. W. I—Contd.					
Jamaica....	Crown land 10 to 20 per cent.				No regulation.
Leeward Islands	80,000	78.0	22,500	22.0	Crown and private forests regulated, except small areas on a few islands.
Trinidad and Tobago	740,500	97.9	16,000	2.1	About one-fourth of crown forest reserved for permanent forest. Cutting on rest controlled by government, but may be cleared.
Windward Islands	75,000	95.5	3,500	4.5	Public forests regulated.
Cuba........	1,950,000	15.0	11,050,000	85.0	No regulation. Has a Forest Service.
Dutch West Indies	All private.				No regulation.
French West Indies	Practically all private.				Strict regulation of private forests.
Haiti........	Large areas in public ownership and considerable private.				No regulation for public or private forests.
Porto Rico...	52,500	11.9	389,000	88.1	Public forests regulated; private not.
Santo Domingo	Mostly in public ownership.				Little regulation of public or private forests. Forest Service established 1920.
Virgin Islands of the United States	All private.				No regulation.

is that economic conditions make conservative methods more profitable than destructive ones, or that public regulation of the handling of private timberlands is effective.

The character of private ownership may also be an important factor. Timberlands ordinarily can be more efficiently and economically managed for continuous production when in sufficiently large units to make possible annual returns, and to warrant the employment of trained managers. It has been the experience in many countries where the desirability of conservative forest management is generally recognized, that the larger private holdings are usually better handled than the small ones, and in some cases even better than those belonging to the public.

A study of the status of forest ownership in the various countries, therefore, does not enable one to draw categorical conclusions as to the relative advantages of public and private ownership, nor does it alone afford any indication as to the progress in forest conservation. It is necessary to know also what legislation, if any, is in force with respect to public and private timberlands, and how far such laws are effective. Data on these points, as well as on the ownership of the forests of many countries, are incomplete. As far as available they are summarized in Tables 15 to 20. Unfortunately, statistical data regarding the size of private holdings are lacking.

TABLE 18.—CHARACTER OF OWNERSHIP IN SOUTH AMERICA

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Argentina	23,100,000[1]	8.7	240,900,000[2]	91.3	Some protection for public forests. Little regulation.
Bolivia	100,000,000	78.1	28,000,000	21.9	No regulation for public or private forests.
Brazil	Large proportion belongs to states, smaller amount to federal government.				Forest Service established by law of December, 1921; to exercise certain control over national forests and private ones where essential for protection.

[1] Besides an unknown area belonging to individual provinces.

[2] Includes an unknown area belonging to individual provinces.

TABLE 18.—CHARACTER OF OWNERSHIP IN SOUTH AMERICA—*Continued*

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
British Guiana	49,204,000	98.8	576,000	1.2	Crown lands regulated. No control over private forests.
Chile	Mostly in public ownership.				Some public forest reserved. Little regulation of others. Coal mining companies raise timber in plantations.
Colombia	Mostly in public ownership.				No regulation of private forests. Laws provide for regulation of cutting on public forests.
Dutch Guiana (Surinam)	Practically all public.				No regulation.
Ecuador	Much owned by the State.				No regulation.
French Guiana (Cayenne)	Practically all public.				No regulation.
Paraguay	750,000	2.0	36,250,000	98.0	No regulation.
Peru	Mostly in public ownership.				No regulation.
Uruguay	....	......	1,070,000	100.0	No regulation.
Venezuela	72,965,000	70.0	30,875,000	30.0	Laws provide for regulation of exploitation of both public and private forests.

The data indicate that about two-thirds of all the forests of the world is owned by the public, and one-third is in the hands of private corporations and individuals. It is significant that the largest proportion of public forest is not in the older countries where the policy of continuous timber production is most firmly established, but in the less developed regions such as tropical Africa, America, Asia, and Australia, and northern North America and Asia. In the older countries the public forests as a rule do not include the lands capable of the greatest production, but are largely residual holdings in the less accessible and more mountainous districts, where the growth of timber is comparatively slow. The private forests are on better sites, whose productive capacity under proper management would be much greater than those belonging to the public.

TABLE 19.—CHARACTER OF OWNERSHIP IN AFRICA.

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Belgian Congo..	....	......	....	......	No forest regulation except as to cutting of certain kinds of timber above a specified size.
British Africa:					
British East Africa	3,200,000	98.0	64,000	2.0	Forest policy in formative stage.
British West Africa:					
Gold Coast and Ashanti	24,390,400	100.0	....	......	Forest policy in formative stage.
Nigeria (Northern, Southern, and Lagos)	139,776,000	100.0	....	......	Forest regulation confined to protection of trees of specified size. Forest policy still in formative stage.
Sierra Leone	218,000	100.0	....	......	Forest regulation just beginning.
Nyasaland....	280,000	100.0	....	......	Considerable planting activities. Forest regulation in formative stage.
Rhodesia (Southern)	35,136,000	60.0	23,424,000	40.0	Public regulation consists of prohibiting the cutting of young trees; also, cutting along public streams, regulation of the use of fire, and special protection for certain species of trees. Forest regulation just beginning.
Uganda......	896,000	100.0	....	......	Practically no public regulation of forests.

TABLE 19.—CHARACTER OF OWNERSHIP IN AFRICA—*Continued*

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
British Africa—Contd.					
Union of South Africa	585,600	39	925,440	61	Fairly strict regulation of public forests. The law provides also for the protection of private forests and regulation of cutting, grazing, pasturing, and hunting and fishing in the forests.
Sudan	. . . .	. . . . .	. . . .	. . . . .	Forest Department protects and manages reserved forests (170,000 acres).
Other British dependencies	. . . .	. . . . .	. . . .	. . . . .	Data lacking. Most of forests are in public ownership, but are not regulated.
Former German Africa	. . . .	. . . . .	. . . .	. . . . .	No public regulation of forests.
French Africa:					
Algeria.	5,592,000	74.6	1,908,000	25.4	Forest Department administers state, communal, and public forest reserves and private forests in which the state, communal and public institutions have joint proprietary rights. The government also is charged with the reforestation of private lands of public importance.
Tunisia.	2,825,000	94.2	175,000	5.8	Forests have been under regulation for the past 35 years.

TABLE 19.—CHARACTER OF OWNERSHIP IN AFRICA—*Continued*

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
French Africa—Contd.					
Other French Colonies	...	...	...	...	No data as to ownership; most of forests public property. Forest regulation just beginning in Morocco; forest policy in formative stage for Ivory Coast. French Congo and probably the others have no forest administration.
Independent States:					
Abyssinia	...	...	...	...	No public regulation of any kind. Forests largely unexplored.
Liberia	...	...	...	...	
Italian Africa	...	...	...	...	No public regulation of any kind. Forests largely unexplored.
Portuguese Africa	...	...	...	...	No public regulation of any kind. Forests largely unexplored.
Spanish Africa	...	...	...	...	No public regulation of any kind. Forests largely unexplored.

Only 10 or 15 per cent of the world's timberland, however, is being handled as a renewable, continuously productive resource, while 15 or 20 per cent additional is more or less protected from destruction but still regarded as a timber-mine, and the greater part, from 65 to 75 per cent, receives no care whatever. By far the greater part of that under conservative management is in public ownership, and public regulation of private forests, with a few exceptions, is extended only to those classed as protection forests, whose preservation is a public necessity.

That it is much more feasible to regulate cutting on public forest lands than on those belonging to private individuals has been proved by the experience of several countries. Norway, France, Germany, Belgium, Italy, and others have been gradually taking back into public ownership the private forest lands whose preservation can not safely be entrusted to private owners, and only recently the United States has undertaken a similar policy, in the purchase of forest lands by the Nation and the

TABLE 20.—CHARACTER OF OWNERSHIP IN AUSTRALIA AND OCEANIA

Country	Public forests		Private forests		Forest regulation
	Area—acres	Per cent	Area—acres	Per cent	
Australian Commonwealth:					
New South Wales	8,000,000	72.7	3,000,000	27.3	Each State of the Commonwealth has an organized forest department. Government supervision over reserved state forests; public control over privately-owned forests in several states.
Queensland...	34,000,000	85.0	6,000,000	15.0	
South Australia......	3,800,000	100.0	....	......	
Tasmania....	1,672,000	15.2	9,328,000	84.8	
Victoria......	7,800,320	97.5	199,680	2.5	
Western Australia......	16,291,200	98.8	200,320	1.2	
Total......	71,563,520	79.3	18,728,000	20.7	
New Zealand...	10,478,080	61.4	6,595,840	38.6	Government regulation of all state forest lands; some regulatory power over cuttings on privately-owned timberlands.
Oceania:					
New Guinea:					
British.....	82,196,000	100.0	....	......	In most cases no forest regulation of any kind, or if there is regulation, it is confined to licenses for cutting timber by the natives.
Dutch.....	77,824,000	100.0	....	......	
Total......	160,020,000	100.0	....	......	
Hawaiian Islands	558,660	54.1	473,180	45.9	Forest reserves under government supervision; no other public control.
Total......	160,578,660	99.7	473,180	.3	
Grand total.	242,619,740	90.4	25,797,020	9.6	

individual States. Canada, on the other hand, has retained most of her timberland, and can adopt conservative methods of handling it without being hampered by conflicts with private property rights. In this respect most of the tropical countries have the advantage of still owning the greater part of their forests. As soon as economic conditions require it they will be able to profit by the experience of the older nations, and to organize their forests as permanent sources of timber both for domestic consumption and for supplying the world markets.

THE WORLD'S PRODUCTION OF WOOD

Approximately 56 billion cubic feet of wood is cut each year from the forests of the world. Of this amount, 26.1 billion feet, or 46.4 per cent, is timber of fair size or good quality, suitable for making sawed lumber and for various industrial uses, while 30.1 billion feet, or 53.6 per cent, is mostly small or inferior material, cut chiefly for firewood.

While the figures are based partly on estimates for countries lacking statistics, those giving the production of saw timber may be accepted as within 15 to 25 per cent of the actual production. For estimating the cut of firewood, however, there was much less complete statistical basis, and the figures given are extremely conservative. A large proportion of that sort of material is cut and used locally, and is not recorded in the statistics even of the most completely organized countries. It would probably not be greatly overstating the facts to say that the total cut of firewood is at least 50 per cent greater than indicated by the tables.[1] By continents, the annual production is as follows:

TABLE 21.—ANNUAL PRODUCTION OF WOOD

Continent	Sawtimber		Firewood		All Wood	
	Total	Per acre	Total	Per acre	Total	Per acre
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*cu. ft.*	*M cu. ft.*	*cu. ft.*
North America....	14,985,615	10.4	12,820,805	8.9	27,806,420	19.3
Europe..........	9,160,236	11.9	7,842,851	10.1	17,003,087	22.0
Asia.............	1,556,268	0.8	6,372,762	3.0	7,929,030	3.8
South America....	258,605	0.12	2,232,860	1.07	2,491,465	1.2
Africa..........	62,450	0.08	654,923	0.82	717,373	0.9
Australia and Oceania.........	92,741	0.33	181,947	0.64	274,688	0.97
Total.........	26,115,915	3.49	30,106,148	4.02	56,222,063	7.51

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[1] Much of the firewood, however, is cut from scattered trees and does not constitute a direct drain upon the forests.

North America produces half of all the wood cut in the world, and North America and Europe together nearly 80 per cent of the total. They produce an even greater proportion of the sawtimber, or more than 90 per cent. Africa cuts the smallest amount of large-sized material, only 0.25 per cent, but with a fairly large cut of firewood has a total production greater than that of Oceania and Australia, which is only 0.5 per cent of the world production.

Coniferous woods constitute about 27.5 billion cubic feet, or 49 per cent of the total, temperate hardwoods about 23.5 billion feet, or 42 per cent, and tropical hardwoods the remainder, only 9 per cent. Of the sawtimber alone the proportion of coniferous wood is still greater, being

TABLE 22.—ANNUAL GROWTH AND PRODUCTION OF WOOD IN EUROPE

Country	Annual growth		Annual cut				Excess	
	Total	Per acre	Sawtimber	Firewood	Total	Average per acre	Cut over growth	Growth over cut
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*	*cu. ft.*	*M cu. ft.*	*M cu. ft.*
Austria	265.000	34.9	132.500	132.500	265.000	34.9		
Belgium	75.789	57.4	28.734	54.470	83.204	63.0	7.415	
Bulgaria	112.000	14.9	18.576	49.616	68.192	9.1		43.808
Czechoslovakia	564.800	45.7	353.000	211.800	564.800	45.7		
Denmark	40.000	45.9	13.500	22.000	35.500	40.7		4.500
Esthonia	68.773	35.0	67.375	55.125	122.500	62.3	53.727	
Finland	1.242.000	25.1	877.776	438.888	1.316.664	26.6	74.664	
France	890.000	36.4	275.000	615.000	890.000	36.4		
Alsace-Lorraine	73.000	67.1	25.000	48.000	73.000	67.1		
Germany	1,545,000	50.0	604.583	567.812	1.172.395	37.9		372.605
Great Britain and Ireland	47.475	14.3	20.000	25.000	45.000	13.6		2.475
Greece	90.000	20.2	36.430	85.002	121.432	27.3	31.432	
Hungary	126.000	40.0	14.200	80.300	94.500	30.0		31.500
Italy	413.222	29.0	72.716	388.356	461.072	32.4	47.850	
Jugo-slavia	690.000	40.0	284.520	499.140	783.660	45.4	93.660	
Latvia	106.384	35.0	68.750	56.250	125.000	41.1	18.616	
Lithuania	156.328	35.0	102.300	83.700	186.000	41.6	29.672	
Luxemburg	6.000	30.4	2.100	3.900	6.000	30.4		
Netherlands	32.042	50.0	16.021	16.021	32.042	50.0		
Norway	320.500	18.8	282.700	149.300	432.000	25.4	111.500	
Poland	777.488	35.5	302.500	365.000	667.500	30.5		109.988
Portugal	100.000	20.0	26.000	74.000	100.000	20.0		
Rumania	370.650	17.0	150.900	150.900	301.800	13.9		68.850
Russia	12.711.000	28.9	4.000.000	3.000.000	7.000.000	15.9		5.711.000
Caucasus[1]	250.000	13.5	125.000	125.000	250.000	13.5		
Spain	120.000	7.1	33.000	127.000	160.000	9.5	40.000	
Sweden	1.312.080	23.6	1.191.415	373.411	1.564.826	28.2	252.746	
Switzerland	81.000	34.9	35.640	45.360	81.000	34.9		
Total	22.586.531	29.2	9.160.236	7.842.851	17.003.087	22.0	761.282	6.344.726
Net excess growth								5.583.444

[1] Includes Asiatic Caucasus.

approximately 75 per cent, as against 22 per cent for temperate hardwoods and less than 3 per cent for tropical hardwoods. These figures show that the economic importance of the conifer forests of the northern hemisphere is far greater than their relative area would indicate, and that

TABLE 23.—ANNUAL GROWTH AND PRODUCTION OF WOOD IN ASIA

Country	Annual growth		Annual cut				Excess	
	Total	Per acre	Sawtimber	Firewood	Total	Average per acre	Cut over growth	Growth over cut
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*	*cu. ft.*	*M cu. ft.*	*M cu. ft.*
Afghanistan	0	0.0	3,190	28,712	31,902	13.6	31,902	....
Arabia	0	0.0	2,500	22,500	25,000	21.7	25,000	....
British East Indies	0	0.0	1,778	3,260	5,038	0.1	5,038	....
Ceylon	25,909	2.0	831	14,799	15,630	1.2	....	9,667
China	1,972,263	10.4	284,163	1,688,100	1,972,263	10.4	....	....
Dutch East Indies	187,914	1.2	10,834	177,080	187,914	1.2	....	....
French Indo-China	79,888	1.3	23,888	56,000	79,888	1.3	....	....
Hongkong	0	0.0	....	1,280	1,280	....	1,280	....
India	1,177,000	4.5	174,000	1,398,275	1,572,275	6.0	395,275	....
Japan	2,540,000	28.1	383,455	1,872,165	2,255,620	24.9	....	284,380
Malay Peninsula	188,256	8.3	25,000	237,500	262,500	11.6	74,244	....
Mesopotamia	0	0.0	712	13,534	14,246	....	14,246	....
Palestine and Syria	0	0.0	914	17,375	18,289	23.8	18,289	....
Persia	0	0.0	14,655	135,941	150,596	4.7	150,596	....
Philippines	554,598	14.4	17,729	17,598	35,327	0.9	....	519,271
Russia (Asiatic)	1,100,000	1.0	571,000	529,000	1,100,000	1.0	....	....
Siam	48,458	1.4	11,058	37,400	48,458	1.4	....	....
Turkey	0	0.0	30,561	122,243	152,804	8.9	152,804	....
Total	7,874,286	3.8	1,556,268	6,372,762	7,929,030	3.8	868,674	813,318
Net excess cut							55,356	

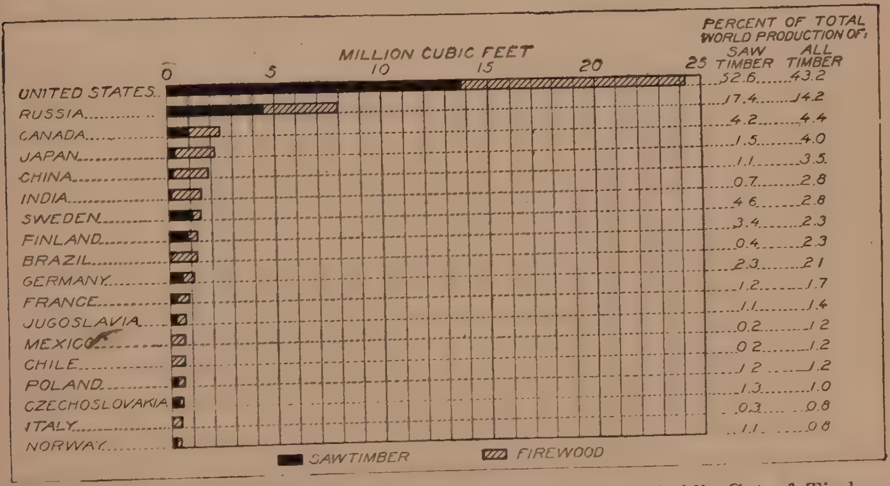

FIG. 3.—Share of the Principal Producing Countries in the World's Cut of Timber

TABLE 24.—ANNUAL GROWTH AND PRODUCTION OF WOOD IN NORTH AND CENTRAL AMERICA

Country	Annual growth		Annual cut				Excess	
	Total	Per acre	Sawtimber	Firewood	Total	Average per acre	Cut over growth	Growth over cut
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*	*cu. ft.*	*M cu. ft.*	*M cu. ft.*
Canada......	0	0.00	1,106,900	1,393,100	2,500,000	4.20	2,500,000	....
Central America:								
British Honduras.	1,350	0.35	930	420	1,350	0.35	0	....
Costa Rica.	9,000	1.00	4,000	5,000	9,000	1.00	0	....
Guatemala..	20,000	1.00	1,000	20,000	21,000	1.00	1,000	....
Honduras...	7,100	0.30	1,100	6,000	7,100	0.30	0	....
Nicaragua..	10,000	0.40	2,000	8,000	10,000	0.40	0	....
Panama....	4,600	0.40	600	4,000	4,600	0.40	0	....
Salvador...	26,700	28.90	12,700	14,000	26,700	28.90	0	....
Mexico.......	0	0.00	42,000	658,000	700,000	9.40	700,000	....
Newfoundland and Labrador........	0	0.00	20,300	47,000	67,300	10.50	67,300	....
United States.	4,265,000	7.70	13,750,000	10,550,000	24,300,000	44.20	20,035,000	....
Alaska.....	0	0.00	12,000	11,000	23,000	0.20	23,000	....
West Indies:								
British West Indies:								
Bahamas.	1,480	4.00	1,000	600	1,600	4.30	120	....
Barbados.	....	.....	....	....	....	......	....	....
Bermuda.	15	10.00	0	5	5	3.30	....	10
Jamaica..	8,500	10.00	3,000	9,000	12,000	14.10	3,500	....
Leeward Islands.	1,400	13.70	0	1,400	1,400	13.70	0	....
Trinidad and Tobago...	20,000	26.40	540	1,900	2,440	3.20	....	17,560
Windward Islands.	1,925	24.50	45	1,880	1,925	24.50	0	....
Cuba......	39,000	3.00	18,000	38,000	56,000	4.30	17,000	....
Dutch West Indies....	200	15.40	0	200	200	15.40	0	....
French West Indies....	2,500	30.30	0	4,000	4,000	48.50	1,500	....
Haiti......	24,500	5.80	4,500	20,000	24,500	5.80	0	....
Porto Rico..	4,400	10.00	4,000	17,000	21,000	47.60	16,600	....
Santo Domingo....	11,000	1.20	1,000	10,000	11,000	1.20	0	....
Virgin Islands....	300	20.00	0	300	300	20.00	0	....
Total..	4,458,970	3.10	14,985,615	12,820,805	27,806,420	19.30	23,365,020	17,570
Net excess cut..........							23,347,450	

TABLE 25.—ANNUAL GROWTH AND PRODUCTION OF WOOD IN SOUTH AMERICA

Country	Annual growth		Annual cut				Excess	
	Total	Per acre	Sawtimber	Firewood	Total	Average per acre	Cut over growth	Growth over cut
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*	*cu. ft.*	*M cu. ft.*	*M cu. ft.*
Argentina	50,000	0.20	77,800	120,000	197,800	0.75	147,800[1]	....
Bolivia	8,550	0.07	2,550	6,000	8,550	0.07	....	....
Brazil	1,300,000	1.30	100,000	1,200,000	1,300,000	1.30	....	....
British Guiana	4,620	0.10	880	3,740	4,620	0.10	....	....
Chile	....	0.00	45,700	638,320	684,020	22.90	684,020[1]	....
Colombia	110,000	0.70	10,000	100,000	110,000	0.70	....	....
Dutch Guiana	1,500	0.06	650	850	1,500	0.06	....	....
Ecuador	50,000	0.90	5,100	50,000	55,100	1.00	5,100	....
French Guiana	550	0.03	100	450	550	0.03	....	....
Paraguay	17,400	0.50	7,400	10,000	17,400	0.50	....	....
Peru	50,025	0.20	25	50,000	50,025	0.20	....	....
Uruguay	21,400	20.00	3,500	18,500	22,000	20.50	600	....
Venezuela	39,900	0.40	4,900	35,000	39,900	0.40	....	....
Total	1,653,945	0.80	258,605	2,232,860	2,491,465	1.20	837,520	....
Net excess cut							837,250	

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[1] In Chile and to a less extent in Argentina, the net growth is very small, because of excessive amount of decay and destruction by fires.

TABLE 26.—ANNUAL GROWTH AND PRODUCTION OF WOOD IN AFRICA

Country	Annual growth		Annual cut				Excess	
	Total	Per acre	Sawtimber	Firewood	Total	Average per acre	Cut over growth	Growth over cut
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*	*cu. ft.*	*M cu. ft.*	*M cu. ft.*
Belgian Congo	0	0.0	3,125	59,375	62,500	0.3	62,500	....
British Africa—total	767,369	2.2	36,587	320,527	357,114	1.0	....	410,255
Basutoland	....	......	....	....	....	.....	....	....
Bechuanaland	....	......	....	....	....	.....	....	....
British East Africa	27,878	8.5	456	12,996	13,452	4.1	....	14,426
British Somaliland	0	0.0	60	1,140	1,200	2.4	1,200	....
Gambia	0	0.0	50	950	1,000	7.7	1,000	....
Gold Coast and Ashanti	425,600	17.4	2,343	13,695	16,038	0.7	....	409,562
Nigeria	86,250	0.6	2,005	84,245	86,250	0.6	....	....
Sierra Leone	6,800	31.2	150	6,650	6,800	31.2	....	....
Egypt and Sudan	7,888	1.1	....	7,888	7,888	1.1	....	....
Nyasaland	0	0.0	854	16,216	17,070	61.0	17,070	....
Rhodesia—Northern	65,504	0.6	5,340	60,164	65,504	0.6	....	....
Southern	42,681	0.7	4,801	56,657	61,458	1.1	18,777	....
Seychelles	100	20.0	5	95	100	20.0	....	....
Swaziland	400	0.4	20	380	400	0.4	....	....
Uganda	0	0.0	672	12,772	13,444	15.0	13,444	....
Union South Africa	104,268	69.0	19,803	46,139	65,942	43.6	....	38,326
Zanzibar	0	0.0	28	540	568	63.1	568	....

TABLE 26.—ANNUAL GROWTH AND PRODUCTION OF WOOD IN AFRICA—*Continued*

Country	Annual growth		Annual cut				Excess	
	Total	Per acre	Saw-timber	Firewood	Total	Average per acre	Cut over growth	Growth over cut
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*	*cu. ft.*	*M cu. ft.*	*M cu. ft.*
Former German Africa—total...	49,720	1.1	2,733	46,987	49,720	1.1	....	....
Cameroon—British..........	3,700	0.4	185	3,515	3,700	0.4	....	....
French..........	9,314	0.4	764	8,550	9,314	0.4	....	....
German East Africa.........	30,800	3.2	1,540	29,260	30,800	3.2	....	....
German Southwest Africa....	800	0.8	40	760	800	0.8	....	....
Togoland..................	5,106	15.0	204	4,902	5,106	15.0	....	....
French Africa—total..........	123,246	0.8	15,553	143,446	158,999	1.0	35,753	....
Algeria....................	15,031	2.0	1,550	13,481	15,031	2.0	....	....
Dahomey...................	4,486	1.6	211	4,275	4,486	1.6	....	....
French Congo...............	44,497	0.6	6,497	38,000	44,497	0.6	....	....
Guinea.....................	9,060	2.8	453	8,607	9,060	2.8	....	....
Ivory Coast................	9,398	0.3	1,978	7,420	9,398	0.3	....	....
Madagascar................	0	0.0	2,075	33,678	35,753	1.5	35,753	....
Morocco...................	27,000	7.3	1,350	25,650	27,000	7.3	....	....
Senegal....................	4,334	4.6	217	4,117	4,334	4.6	....	....
Reunion...................	890	127.1	44	846	290	127.1	....	....
Tunisia....................	8,550	2.9	1,178	7,372	8,550	2.9	....	....
Independent States:								
Abyssinia..................	0	0.0	1,600	30,400	32,000	2.2	32,000	....
Liberia....................	10,000	0.6	500	9,500	10,000	0.6	....	....
Italian Africa:								
Tripoli (Libya)..............	0	0.0	200	3,800	4,000	1.6	4,000	....
Others....................	0	0.0	220	4,180	4,400	......	4,400	....
Portuguese Africa—total.......	37,640	1.3	1,882	35,758	37,640	1.3	....	....
Angola (and Kabinda).......	20,595	2.1	1,030	19,565	20,595	2.1	....	....
Portuguese East Africa.......	15,600	0.8	780	14,820	15,600	0.8	....	....
Portuguese Guinea..........	1,445	1.6	72	1,373	1,445	1.6	....	....
Spanish Africa:								
Rio Muni..................	1,000	0.2	50	950	1,000	0.2	....	....
Grand total.............	988,975	1.2	62,450	654,923	717,373	0.9	200,712	462,314
Net excess growth........								261,602

they are the forests whose perpetuation and even extension is most essential to keep the world supplied with timber.

The annual production of sawtimber and firewood by individual countries is shown in Tables 22–27, together with such data as are available regarding growth in the forests.

TABLE 27.—ANNUAL GROWTH AND PRODUCTION OF WOOD IN AUSTRALIA AND OCEANIA

Country	Annual growth		Annual cut				Excess	
	Total	Per acre	Saw-timber	Firewood	Total	Average per acre	Cut over growth	Growth over cut
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*	*cu. ft.*	*M cu. ft.*	*M cu. ft.*
Australian Commonwealth—total	428,048	4.70	49,874	147,505	197,379	2.20	....	230,669
New South Wales	110,000	10.00	11,853	50,000	61,853	5.60	....	48,147
Queensland	7,333	0.20	11,726	9,000	20,726	0.50	13,393	....
South Australia	38,000	10.00	223	11,143	11,366	3.00	....	26,634
Tasmania	110,000	10.00	4,298	5,222	9,520	0.90	....	100,480
Victoria	149,400	18.70	8,333	40,140	48,473	6.10	....	100,927
Western Australia	13,315	0.80	13,441	32,000	45,441	2.80	32,126	....
New Zealand	34,000	2.00	42,000	25,000	67,000	3.90	33,000	....
Oceania:								
New Guinea—total	3,600	0.02	180	3,420	3,600	0.02	....	....
British	2,000	0.02	100	1,900	2,000	0.02	....	....
Dutch	1,600	0.02	80	1,520	1,600	0.02	....	....
Melanesia:								
Bismarck Archipelago	940	0.10	47	893	940	0.10	....	....
New Caledonia	281	0.60	15	266	281	0.60	....	....
New Hebrides	253	0.70	13	240	253	0.70	....	....
Solomon Islands	900	0.20	45	855	900	0.20	....	....
All others	150	0.60	8	142	150	0.60	....	....
Micronesia:								
Guam	45	7.00	2	43	45	7.00	....	....
Hawaiian Islands	3,000	2.90	500	2,500	3,000	2.90	....	....
All others	....	....	....	....	....	....	....	....
Polynesia:								
Fiji	605	0.50	30	575	605	0.50	....	....
Samoa	195	0.40	10	185	195	0.40	....	....
Society Islands (Tahiti, Kaukura and Faaiti)	93	0.90	5	88	93	0.09	....	....
All others	247	0.80	12	235	247	0.80	....	....
Total	10,309	0.60	867	9,442	10,309	0.60	....	....
Grand total	472,357	1.70	92,741	181,947	274,688	1.00	78,519	276,188
Net excess growth								197,669

THE AMOUNT OF WOOD GROWN

Forests differ from most other kinds of natural resources in that they can be exploited so as to furnish timber continuously without exhausting the supply. If properly handled the wood taken out each year can be replaced by growth of new wood, and the stand may even be increased over what was on the ground originally. As yet, however, only a very small proportion of the forests of the world are handled with any regard for the production of new growth. The total cut appears very small when compared with the total acreage of forest land—only 7.5 cubic feet per acre; but it must be remembered that most of this cut is concentrated in a few regions, and the greater part of the land cut over is not left in such a condition that it can produce successive timber crops as good as the first. In the unexploited forests, where practically no cutting is being done, growth merely fills the gaps left by accidental losses due to natural causes, and does not result in an increase in the volume of standing timber. For these reasons, the total cut of wood in the world is considerably greater than the net growth after allowing for losses by fire, decay, and similar agencies, and consequently the total timber supply is being steadily diminished.

The total quantity of wood grown each year is roughly estimated at about 38 billion cubic feet. This is a most speculative figure, as satisfactory data are available for only a few countries. If this increment were spread evenly over the whole forest area, it would amount to only 5.1 cubic feet per acre. As a matter of fact, however, it represents the growth of only a small part of the forest. Vast areas of virgin tropical forest as well as much of the virgin forest of the temperate regions were left out of the calculation, because in their present condition there is no net growth to amount to anything. Twenty-two billion cubic feet, or more than half of the growth which is actually taking place at the present time, is in the forests of Europe, a large proportion of which are under management for the production of timber. If all the forests of the world were placed in a growing condition, even without very much care other than a moderate amount of protection against devastation, they could produce annually at least 350 billion cubic feet of wood, or nearly 50 cubic feet per acre. Under intensive management the growth would be much greater.

It is clear that, as far as the total volume of wood is concerned, there are still ample forests in the world to furnish all the timber needed for many years to come. But the kind of timber produced, and the region where it is produced, must also be considered.

Comparison of the cut and present growth for each of the three kinds of forest results as follows:

Kind of forest	Cut		Growth	
	Total	Per acre	Total	Per acre
	million cu. ft.	*cu. ft.*	*million cu. ft.*	*cu. ft.*
Conifers	27,500	10.4	23,500	8.9
Temperate hardwoods	23,500	19.6	9,500	8.0
Tropical hardwoods	5,000	1.4	5,000	1.4

One-half of all the wood, including three-quarters of all the sawtimber, is cut from conifer forests, which are practically confined to the northern temperate regions. The annual growth in these forests, except on very limited areas, even under careful management will not exceed 60 to 80 cubic feet per acre, and in many regions will be much less than that figure. Next in volume is the cut of temperate hardwoods, also principally in the northern hemisphere. They will not grow as fast, on the average, as the conifers. The cut of tropical hardwoods at the present time is only 9 per cent of the total, or 3 per cent of the sawtimber, yet

TABLE 28.—*A*. COUNTRIES WHOSE FOREST RESOURCES ARE UTILIZED FULLY OR TO A LARGE EXTENT

1. Countries in which the cut exceeds the growth:

Country	Growth	Cut
	Cubic feet per acre	
Europe:		
Belgium	57.4	63.0
Denmark	40.7	45.9
Esthonia	35.0	62.3
Finland	25.1	26.6
Greece	20.2	27.3
Italy	29.0	32.4
Jugo-slavia	40.0	45.9
Latvia	35.0	41.1
Lithuania	35.0	41.6
Norway	18.8	25.4
Spain	7.1	9.5
Sweden	23.6	28.2
Asia:		
Afghanistan	0.0	13.6
Arabia	0.0	21.7
Palestine and Syria	0.0	23.8
Turkey	0.0	8.9
North America:		
French West Indies	30.3	48.8
Jamaica	10.0	14.1
Newfoundland	0.0	10.5
Porto Rico	10.0	47.6
United States	7.7	44.2
South America:		
Chile	0.0	22.9
Africa:		
Libya (Tripoli)	0.0	1.6
Nyasaland	0.0	61.0
Uganda	0.0	15.0
Zanzibar	0.0	63.1

TABLE 28.—*A—Continued*

2. Countries where cut and growth balance:

Country	Growth	Cut
	Cubic feet per acre	
Europe:		
Austria	34.9	34.9
Czechoslovakia	45.7	45.7
France	36.4	36.4
Alsace-Lorraine	67.1	67.1
Luxemburg	30.4	30.4
Netherlands	50.0	50.0
Portugal	20.0	20.0
Caucasus	13.5	13.5
Switzerland	34.9	34.9
Asia:		
China	10.4	10.4
North America:		
British West Indies (except Jamaica and Trinidad)	8.8	8.9
Dutch West Indies	15.4	15.4
Salvador	28.9	28.9
Virgin Islands	20.0	20.0
South America:		
Uruguay	20.0	20.5
Africa:		
Sierra Leone	31.2	31.2

3. Countries where the growth exceeds the cut:

Country	Growth	Cut
	Cubic feet per acre	
Europe:		
Bulgaria	14.9	9.1
Germany	50.0	37.9[1]
Great Britain and Ireland	14.3	13.6
Hungary	40.0	30.0[1]
Poland	35.5	30.5[1]
Rumania	17.0	13.9
European Russia	28.9	15.9
Asia:		
Japan	28.1	24.9
Africa:		
Union of South Africa	69.0	43.6

[1] These figures based on pre-war conditions. Cut may exceed growth now.

TABLE 28.—*B*. COUNTRIES WHOSE FORESTS ARE MOSTLY UNEXPLOITED; BOTH GROWTH AND CUT VERY SMALL, CONSIDERING THE EXTENT OF THE RESOURCES

1. Countries in which the cut exceeds the growth:

Country	Growth	Cut
	Cubic feet per acre	
Asia:		
British Borneo	0.0	0.1
India	4.5	6.0
Malay Peninsula	8.3	11.6
Persia	0.0	4.7
North America:		
Alaska	0.0	0.2
Canada	0.0	4.2
Cuba	3.0	4.3
Mexico	0.0	9.4
South America:		
Argentina	0.2	0.75
Africa:		
Abyssinia	0.0	2.2
Belgian Congo	0.0	0.3
British Somaliland	0.0	2.4
Gambia	0.0	7.7
Madagascar	0.0	1.5
Southern Rhodesia	0.7	1.0
Oceania:		
New Zealand	2.0	3.9

2. Countries where cut and growth balance:

Country	Growth	Cut
	Cubic feet per acre	
Asia:		
Dutch East Indies	1.2	1.2
French Indo-China	1.3	1.3
Asiatic Russia	1.0	1.0
Siam	1.4	1.4
North America:		
Central America (except Salvador)	0.3 to 1.0 avg. 0.55	0.3 to 1.0 0.55
Haiti	5.8	5.8
Santo Domingo	1.2	1.2
South America:		
Bolivia	0.07	0.07
Brazil	1.3	1.3
Colombia	0.7	0.7
Ecuador	0.9	1.0
Guiana (British, French, and Dutch)	0.08	0.08
Paraguay	0.5	0.5

TABLE 28.—B—*Continued*

2. Countries where cut and growth balance—*Continued*:

Country	Growth	Cut
	Cubic feet per acre	
South America—Continued:		
Peru	0.2	0.2
Venezuela	0.4	0.4
Africa:		
Egypt and Sudan	1.1	1.1
French Africa (except Madagascar)	0.1 to 7.3 avg. 0.64	0.1 to 7.3 0.64
German Africa	0.4 to 15.0 avg. 1.1	0.4 to 15.0 1.1
Liberia	0.6	0.6
Nigeria	0.6	0.6
Northern Rhodesia	0.6	0.6
Portuguese Africa	0.8 to 2.1 avg. 1.3	0.8 to 2.1 1.3
Spanish Guinea	0.2	0.2
Swaziland	0.4	0.4
Oceania:		
All except Australia and New Zealand	0.0 to 7.0 avg. 0.6	0.0 to 7.0 0.6

3. Countries where the growth exceeds the cut:

Country	Growth	Cut
	Cubic feet per acre	
Asia:		
Ceylon	2.0	1.2
Philippines	14.4	0.9
North America and West Indies:		
Trinidad	26.4	3.2
Africa:		
British East Africa	8.5	4.1
Gold Coast	17.4	0.7
Australia:		
Australian Commonwealth	4.7	2.2

the possible annual growth in tropical forests may reach 300 or more cubic feet per acre.

The quantities of timber which are estimated to grow annually in the individual countries are given in the same tables with the statistics of production, above. It should be clearly understood that these figures represent the net increment that is actually taking place now, after allowing for losses due to fires, decay, and other natural causes. While in some of the countries whose timberlands are intensively managed and utilized the figures may represent nearly the potential wood-yielding capacity of the forests, in most cases they are much less. In the little-developed tropical regions, especially, as well as in Siberia and Alaska and to a less extent in Canada, the potential increment is many times what is being added now, and the growth will increase rapidly as more of the forests are cut over, provided they are not devastated. Many countries in which the present cut exceeds the growth, therefore, can not be considered to be overcutting their forests. With proper management they can increase their production many fold without reducing the timber capital.

In Table 28 the individual countries are classified with respect to the present growth and production of timber. In using the figures for both cut and growth, it should be remembered that except for the Europeon countries and a few others they are only estimates, for which no high degree of accuracy can be claimed.

THE WORLD'S CONSUMPTION OF WOOD

The total consumption of wood in the world is approximately 56 billion cubic feet,[1] which is an average of 32 cubic feet per capita. Almost half of it, or nearly 26 billion feet, is sawtimber and 30 billion feet is firewood. The consumption of sawtimber and firewood by continents is as follows:

TABLE 29.—ANNUAL CONSUMPTION OF WOOD

Continent	Total	Per capita	Sawtimber	Firewood	Per cent saw-timber
	million cu. ft.	*cu. ft.*	*million cu. ft.*	*million cu. ft.*	
North America	27,192	188.0	14,372	12,820	52.8
Europe	16,641	35.8	8,844	7,797	53.1
Asia	7,917	9.1	1,539	6,378	19.4
South America	2,527	39.2	294	2,233	11.6
Africa	774	5.7	114	660	14.7
Australia and Oceania	297	36.1	114	183	38.6
Total	55,348	32.2	25,277	30,071	45.6

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[1] The figures for total cut and those for total consumption for the world as a whole do not exactly correspond, although as a matter of fact they must be approximately equal. The differences are due to various discrepancies in the data, such as differences in the years for which figures on individual countries are based, different converting factors used in different countries, and differences in completeness of customs statistics.

It is interesting to compare the amounts of wood used in the various continents, in relation to their population. North America, with one-twelfth of the world's inhabitants, uses close to half of all the timber and more than half of all the sawtimber. Its per capita consumption is five times as great as that of Europe, and if the tropical countries south of the United States, all of which have a very low consumption, be left out, it is 6½ times that of Europe. Europe, South America, and Australia use about equal amounts of wood per capita; the proportion of sawtimber to total wood used, however, is quite different, being only one-

TABLE 30.—ANNUAL CONSUMPTION IN EUROPE

Country	Total consumption	Per capita consumption	Sawtimber	Firewood	Per cent sawtimber
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	
Austria	215,000	35.0	82,500	132,500	38.4
Belgium	182,996	24.4	125,909	57,087	68.8
Bulgaria	74,196	13.5	26,081	48,115	35.2
Czechoslovakia	458,900	32.8	247,100	211,800	53.8
Denmark	70,500	24.0	47,000	23,500	66.7
Esthonia	122,500	70.0	67,375	55,125	55.0
Finland	1,001,504	299.0	606,930	394,574	60.6
France	1,023,910	26.3	399,910	624,000	39.1
Alsace-Lorraine	75,000	42.9	26,500	48,500	35.3
Germany	1,702,395	27.0	1,134,583	567,812	66.6
Great Britain and Ireland	693,719	15.3	668,719	25,000	96.4
Greece	127,273	26.8	40,661	86,612	31.9
Hungary	94,500	12.0	14,200	80,300	15.0
Italy	595,072	15.4	206,716	388,356	34.7
Jugo-slavia	641,400	43.3	142,260	499,140	22.2
Latvia	125,000	50.0	68,750	56,250	55.0
Lithuania	186,000	40.0	102,300	83,700	55.0
Luxemburg	6,000	22.7	2,100	3,900	35.0
Netherlands	104,190	15.8	88,169	16,021	84.6
Norway	311,000	118.2	161,700	149,300	52.0
Poland	577,000	22.7	212,000	365,000	36.7
Portugal	80,645	13.4	20,000	60,645	24.8
Rumania	282,358	16.1	131,458	150,900	46.6
Russia	6,600,000	66.0	3,600,000	3,000,000	54.5
Caucasus	248,676	18.8	123,222	125,454	49.6
Spain	186,853	9.4	62,353	124,500	33.4
Sweden	749,710	129.3	383,355	366,355	51.1
Switzerland	105,000	28.0	52,440	52,560	49.9
Total	16,641,297	35.8	8,844,291	7,797,006	53.1

ninth in South America, two-fifths in Australia, and over half in Europe. Asia and Africa use comparatively small amounts of wood, and most of what they do use is for fuel.

Detailed statistics of the consumption in individual countries are presented in Tables 30 to 35.

The differences in the rate of use of wood by different peoples are very striking. Many factors influence the amount of timber a country uses. Among the most important are the racial habits and standards of living of the people, especially as regards housing; the industrial development of the country, together with its tendency to increase or decrease in population; the climate, with its effect on character of buildings and use of fuel; the available supplies of coal and oil for domestic and industrial fuel, and of iron and stone for building; and the relative abundance of timber for construction, industrial uses, and fuel. Considering these various factors it is easy to understand why the consumption is very large in countries like Canada, the United States, Finland, Sweden, and Norway, and why it is small in such countries as

TABLE 31.—ANNUAL CONSUMPTION IN ASIA

Country	Total consumption	Per capita consumption	Sawtimber	Firewood	Per cent sawtimber
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	
Afghanistan	31,902	5.0	3,190	28,712	10.0
Arabia	25,000	5.0	2,500	22,500	10.0
British East Indies	3,560	4.0	178	3,382	5.0
Ceylon	15,735	3.4	936	14,799	5.9
China	1,986,000	6.0	297,900	1,688,100	15.0
Dutch East Indies	186,400	4.0	9,320	177,080	5.0
French Indo-China	80,000	4.7	24,000	56,000	30.0
Hongkong	5,280	12.0	4,000	1,280	75.8
India	1,575,000	5.0	176,725	1,398,275	11.2
Japan	2,220,000	28.4	347,835	1,872,165	15.7
Malay Peninsula	275,000	90.9	31,500	243,500	11.5
Mesopotamia	14,246	5.0	712	13,534	5.0
Palestine and Syria	18,289	5.0	914	17,375	5.0
Persia	150,000	15.0	15,000	135,000	10.0
Philippines	35,300	3.9	17,702	17,598	50.1
Russia (Asiatic)	1,098,000	52.1	569,000	529,000	51.8
Siam	44,000	5.0	6,600	37,400	15.0
Turkey	152,804	15.0	30,561	122,243	20.0
Total	7,916,516	9.1	1,538,573	6,377,943	19.4

Great Britain, France, Germany, Belgium, Holland, and Italy, and even smaller in many of the undeveloped tropical regions.

In most new countries, if timber is abundant it is usually the principal source of fuel for domestic and industrial use. In regions with a cool climate the consumption of wood fuel is fairly large at first, but tends to decrease gradually as other resources are developed, such as coal, oil,

Table 32.—Annual Consumption in North and Central America

Country	Total consumption	Per capita consumption	Sawtimber	Firewood	Per cent sawtimber
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	
Canada	2,058,440	285.0	665,340	1,393,100	32.3
Central America:					
British Honduras	595	14.0	175	420	29.4
Costa Rica	9,050	19.5	4,050	5,000	44.7
Guatemala	20,830	9.3	830	20,000	4.0
Honduras	8,000	12.7	2,000	6,000	25.0
Nicaragua	8,950	12.1	950	8,000	10.6
Panama	6,400	14.3	2,400	4,000	37.5
Salvador	26,700	20.0	12,700	14,000	47.5
Mexico	710,000	45.8	52,000	658,000	7.3
Newfoundland and Labrador	61,000	251.0	14,000	47,000	22.9
United States	24,104,000	228.0	13,556,000	10,548,000	56.2
Alaska	22,995	418.0	11,995	11,000	52.2
West Indies:					
British West Indies:					
Bahamas	1,375	24.1	775	600	56.4
Barbados	2,300	11.5	1,000	1,300	43.5
Bermuda	205	9.8	200	5	97.5
Jamaica	11,500	12.8	2,500	9,000	21.7
Leeward Islands	1,650	11.7	250	1,400	15.1
Trinidad-Tobago	3,180	8.2	1,280	1,900	40.3
Windward Islands	2,000	11.1	200	1,800	10.0
Cuba	65,500	22.6	27,500	38,000	42.0
Dutch West Indies	350	6.0	150	200	42.9
French West Indies	5,100	11.7	1,100	4,000	21.6
Haiti	23,500	15.7	3,500	20,000	14.9
Porto Rico	26,650	20.5	9,650	17,000	36.2
Santo Domingo	11,170	11.7	1,170	10,000	10.5
Virgin Islands	350	13.5	50	300	14.3
Total	27,191,790	188.0	14,371,765	12,820,025	52.8
Total U. S. and north	26,246,435	232.0	14,247,335	11,999,100	54.3
Total south of U. S.	945,355	29.5	124,430	820,925	13.2

or hydroelectric power, or as wood becomes scarcer and the facilities better for bringing in coal. For this reason, if other conditions are the same, the proportion of firewood to total consumption may be larger in new countries than in more intensively developed ones. The ratio of firewood to the total is lowest in Great Britain, Holland, Belgium, Denmark, and Germany, because their forest resources are insufficient for their needs, while coal is easy to get. They therefore use large quantities of coal for fuel and import a great deal of sawtimber to supplement what their own forests produce. In the United States, Norway, Sweden, Finland, Russia, and the Baltic States the proportion of sawtimber is also high, but for a different reason. These countries (or their close neighbors) are amply supplied with softwood forests, wood is extensively used for building, and the consumption of sawtimber is larger even than that of fuelwood, which is several times as great as in the western European countries.

In most of the tropical countries, even though timber supplies may be ample, the requirements for timber are in most cases very small. Wood-using industries are almost unknown, wooden houses are exceptional, fuel is needed for few purposes except cooking, and but little for that. With increasing settlement by northern races, the consumption of sawtimber tends to increase. They generally prefer, however, to import the easily

TABLE 33.—ANNUAL CONSUMPTION IN SOUTH AMERICA

Country	Total consumption	Per capita consumption	Sawtimber	Firewood	Per cent sawtimber
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	
Argentina	225,800	27.3	106,800	119,000	47.3
Bolivia	10,000	3.5	1,000	6,000	40.0
Brazil	1,296,900	42.5	96,900	1,200,000	7.5
British Guiana	4,270	13.7	1,390	2,880	32.5
Chile	687,620	177.7	49,300	638,320	7.2
Colombia	110,000	20.1	10,000	100,000	9.1
Dutch Guiana	1,000	11.0	150	850	15.0
Ecuador	55,175	27.6	5,175	50,000	9.4
French Guiana	525	10.5	75	450	14.3
Paraguay	11,600	14.5	1,600	10,000	13.8
Peru	55,000	9.5	5,000	50,000	9.1
Uruguay	29,000	20.3	9,000	20,000	31.0
Venezuela	40,000	14.1	5,000	35,000	12.5
Total	2,526,890	39.2	294,390	2,232,500	11.6

TABLE 34.—ANNUAL CONSUMPTION IN AFRICA

Country	Total consumption	Per capita consumption	Sawtimber	Firewood	Per cent sawtimber
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	
Belgian Congo	62,500	5.0	3,125	59,375	5.0
British Africa—total	401,791	7.7	78,343	323,448	19.5
Basutoland	1,214	3.0	61	1,153	5.0
Bechuanaland	375	3.0	19	356	5.0
British East Africa	13,285	5.0	289	12,996	2.2
British Somaliland	1,200	4.0	60	1,140	5.0
Gambia	1,000	5.0	50	950	5.0
Gold Coast and Ashanti	15,000	10.0	1,305	13,695	8.7
Nigeria	86,250	5.0	2,005	84,245	2.3
Sierra Leone	7,000	5.0	350	6,650	5.0
Egypt and Sudan	32,300	2.0	23,000	9,300	71.2
Nyasaland	17,070	15.0	854	16,216	5.0
Rhodesia—Northern	65,504	73.6	5,340	60,164	8.2
Southern	61,682	73.6	5,025	56,657	8.1
Seychelles	100	4.0	5	95	5.0
Swaziland	400	4.0	20	380	5.0
Uganda	13,444	4.0	672	12,772	5.0
Union South Africa	85,399	14.2	39,260	46,139	46.0
Zanzibar	568	5.0	28	540	5.0
Former German Africa—total	49,460	4.3	2,473	46,987	5.0
Cameroon—British	3,700	5.0	185	3,515	5.0
French	9,000	5.0	450	8,550	5.0
German East Africa	30,800	4.0	1,540	29,260	5.0
German Southwest Africa	800	4.0	40	760	5.0
Togoland	5,160	5.0	258	4,902	5.0
French Africa—total	170,284	5.5	25,671	144,613	15.1
Algeria	27,530	4.9	14,199	13,331	51.6
Dahomey	4,500	5.0	225	4,275	5.0
French Congo	40,000	5.0	2,000	38,000	5.0
Guinea	9,060	5.0	453	8,607	5.0
Ivory Coast	7,810	5.0	390	7,420	5.0
Madagascar	35,450	10.0	1,772	33,678	5.0
Mauretania	768	3.0	38	730	5.0
Morocco	28,624	5.3	2,974	25,650	10.4
Sahara Territory	....	....	....	....	......
Senegal	4,774	3.3	657	4,117	13.8
Somaliland	618	3.0	31	587	5.0
Reunion	890	5.0	44	846	5.0
Tunisia	10,260	5.3	2,888	7,372	28.1

TABLE 34.—ANNUAL CONSUMPTION IN AFRICA.—*Continued.*

Country	Total consumption	Per capita consumption	Sawtimber	Firewood	Per cent sawtimber
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	
Independent States:					
Abyssinia	32,000	4.0	1,600	30,400	5.0
Liberia	10,000	5.0	500	9,500	5.0
Italian Africa—total	8,400	4.0	420	7,980	5.0
Eritrea	1,800	4.0	90	1,710	5.0
Italian Somaliland	2,600	4.0	130	2,470	5.0
Tripoli	4,000	4.0	200	3,800	5.0
Portuguese Africa—total	37,640	5.0	1,882	35,758	5.0
Angola (and Kabinda)	20,595	5.0	1,030	19,565	5.0
Portuguese East Africa	15,600	5.0	780	14,820	5.0
Portuguese Guinea	1,445	5.0	72	1,373	5.0
Spanish Africa—total	2,241	2.7	112	2,129	5.0
Morocco	1,240	2.0	62	1,178	5.0
Rio de Oro	1	2.0	....	1	5.0
Rio Muni	1,000	5.0	50	950	5.0
Grand total	774,316	5.7	114,126	660,190	14.7

worked softwoods with which they are familiar instead of utilizing the native hardwoods. In a few countries like Brazil which have fairly important industries and railroads, fuelwood still constitutes a very large proportion of the total consumption because other kinds of fuel are not readily available.

It is evident that the tropical countries will never use wood to the same extent as those farther north, nor will those countries of the temperate zone whose forest resources are insufficient use as much as others which have abundant supplies. There will doubtless be a tendency for the per capita consumption to decrease in the countries which now use the largest amounts, as their timber supplies become reduced, and at the same time there will be an increase in the relative consumption of countries which now use little. It is difficult to establish any one figure to represent what may be called the "normal" requirement for wood—the amount which a country must have in order that its economic development may not be impeded. The following are suggested as the approxi-

TABLE 35.—ANNUAL CONSUMPTION IN AUSTRALIA AND OCEANIA

Country	Total consumption	Per capita consumption	Sawtimber	Firewood	Per cent sawtimber
	M cu. ft.	*cu. ft.*	*M cu. ft.*	*M cu. ft.*	
Australian Commonwealth:					
New South Wales	72,461	36.2	22,461	50,000	31.0
Queensland	18,732	26.8	9,732	9,000	52.0
South Australia	18,769	42.1	7,626	11,143	40.6
Tasmania	7,773	37.2	2,551	5,222	32.8
Victoria	58,764	41.1	18,624	40,140	31.7
Western Australia	37,253	112.3	5,253	32,000	14.1
Total	213,752	41.8	66,247	147,505	31.0
New Zealand	63,269	59.7	38,269	25,000	60.5
Oceania:					
New Guinea:					
British	2,000	4.0	100	1,900	5.0
Dutch	1,600	4.0	80	1,520	5.0
Melanesia:					
Bismarck Archipelago	940	5.0	47	893	5.0
New Caledonia	280	5.0	14	266	5.0
New Hebrides	253	5.0	13	240	5.0
Solomon Islands	900	5.0	45	855	5.0
All others	150	5.0	8	142	5.0
Micronesia:					
Guam	45	5.0	2	43	5.0
Hawaiian Islands	11,000	43.0	8,500	2,500	77.3
All others	433	5.0	22	411	5.0
Polynesia:					
Fiji	1,605	13.3	1,030	575	64.2
Samoa	195	5.0	10	185	5.0
Society Islands (Tahiti, Kaukura, and Faaiti)	93	5.0	5	88	5.0
All others	247	5.0	12	235	5.0
Total	19,741	10.0	9,888	9,853	50.1
Grand total	296,762	36.4	114,404	182,358	38.6

mate rates at which the per capita consumption of the different regions may become established during the next few decades:

	Cu. ft.
United States, Canada, Finland, Siberia	200
Russia, Norway, Sweden, Baltic States	100
Brazil, Chile, Argentina, Australia, New Zealand	75
Mexico, Central America, northern and western South America	50
Central and western Europe, Japan	30
Southern Europe, Asia Minor, South Africa, West Indies	15
China, India, Indo-China, East Indies, north Africa	10–15
Equatorial Africa	10

In spite of the increasing use of substitutes for wood, the world's requirements for timber are steadily increasing instead of diminishing. Particularly is this true of growing industrial nations like the United States, Great Britain, Germany, Belgium, and Italy. In some countries the increase in wood consumption is more rapid than the growth of population, in others it is not quite as fast. Countries such as France, whose population is stationary, show very little increase in the total amount of wood used. Statistics show that during the last few decades the total consumption of timber (excluding firewood) has increased in France at the rate of about 0.1 per cent a year, in Germany 1.4 per cent, in the United States 1.6 per cent, in Great Britain 1.8 per cent, and in Belgium and Italy 2.0 per cent. These countries use nearly two-thirds of the sawtimber consumed in the world. The weighted average of the above figures gives an annual increase for the world of 1.45 per cent, which means that the consumption will double about every fifty years.

THE WORLD TRADE IN WOOD

Under normal conditions about 3,750 million cubic feet of wood, valued at about $650,000,000 before the war, goes into international trade each year. Almost all of it is timber for construction or industrial use, as firewood cannot economically be shipped to points far distant from where it is produced. The total volume of exports and imports for the different continents is given on page 58.

These figures of course do not show how much timber is exported from or imported into each continent as a whole, because much of the trade is between countries on the same continent. In general, however, it may be stated that the intercontinental timber trade is comparatively small. Northern Europe and northern North America export considerable quantities of conifer timber for construction to all of the other continents; southeastern Europe, eastern United States, and Japan send temperate hardwoods to other parts of the world, and Europe and North

Continent	Exports	Imports
	Million cu. ft.	
Europe	2,326	1,965
North America	1,317	703
Asia	50	38
South America	32	67
Australia—Oceania	22	43
Africa	11	64
Total	3,758	2,880[1]

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[1] The total exports and imports should be the same. The discrepancy is due to differences in completeness and accuracy of trade statistics for the different countries, to differences in the years for which figures were available, and probably also to differences in units of measurement and converting factors.

America import comparatively small quantities of tropical woods from South America, Australia, Africa, and southern Asia.

Of the total volume of trade about 80 per cent is composed of conifers, principally for construction and paper pulp. The temperate hardwoods, used for staves, railroad ties, furniture, finish, cabinet work, and other special purposes, constitute about 18 per cent, while tropical hardwoods, which so far are exported almost solely as furniture, cabinet, dye, and tanning woods, are only 2 per cent of the total. The tropical woods and to a considerable extent the temperate hardwoods may be classed as luxuries rather than necessities, and the commerce in them depends more or less upon artificial stimulation and specialized tastes. For example, lack of native woods suitable for the same purposes is not the reason why the United States imports large quantities of mahogany and other tropical cabinet woods. On the contrary, it exports at the same time oak, walnut, gum, and other woods for furniture and interior finish, as well as ash, hickory, and various woods for special uses. Nor have the tropical woods been imported because they could be obtained for lower prices than the temperate hardwoods, for the contrary has been the case. As the hardwood forests in temperate regions become depleted of their finest timber, however, the tropics are almost certain to be called upon more and more to supply the world's requirements for this class of material.

Because only those sorts of woods have been exported from the tropics, the idea is rather general that the equatorial forests are entirely composed of hard, heavy, deeply colored woods, suitable for furniture and fine cabinet work, but not for general use in construction. As a matter of fact, there are many excellent construction woods, which are superior even to the conifers for use in the tropics, because of their greater resistance to decay and termites. They may eventually be used to some extent in the northern countries, but because of high transportation costs and the fixed habits of the people of those countries, they

TABLE 36.—AVERAGE TIMBER EXPORTS AND IMPORTS, EUROPE

Country	Exports	Imports	Excess of	
			Exports over imports	Imports over exports
	M cu. ft.	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*
Austria	50,000[1]	...	50,000	...
Belgium	5,938	105,730	...	99,792
Bulgaria	1,750	7,754	...	6,004
Czechoslovakia	105,900[1]	...	105,900	...
Denmark	...	35,000	...	35,000
Esthonia	...	...	...	...
Finland	316,160	1,000	315,160	...
France	70,175	204,085	...	133,910
Alsace-Lorraine	9,000	11,000	...	2,000
Germany	...	530,000	...	530,000
Great Britain and Ireland	8,265	656,984	...	648,719
Greece	3	5,844	...	5,841
Hungary	...	...	...	...
Italy	...	134,000	...	134,000
Jugo-slavia	142,260[1]	...	142,260	...
Latvia	...	...	...	...
Lithuania	...	...	...	...
Luxemburg	...	...	...	...
Netherlands	110,347	182,495	...	72,148
Norway	133,400	12,400	121,000	...
Poland	90,500[1]	...	90,500	...
Portugal	21,980	2,625	19,355	...
Rumania	22,305	2,863	19,442	...
Russia	400,000	...	400,000	...
European Caucasus	1,778	454	1,324	...
Spain	4,641	31,494	...	26,853
Sweden	832,116	17,000	815,116	...
Switzerland	...	24,000	...	24,000
Total	2,326,518	1,964,728	2,080,057	1,718,267
Net exports			361,790	

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[1] Estimated amount which can be exported, based on estimated cut and domestic requirements and pre-war trade of Austria-Hungary. No statistics available for these countries separately.

will never be able to compete there successfully with the conifers. The great consuming regions of the world will always look to the conifer forests for supplies of building material.

The average exports and imports of timber for the various individual countries, as far as data are available, are shown in Tables 36–41.

The principal exporting countries of Europe are Austria, Czechoslovakia, Poland, Jugo-slavia, Norway, Finland, Russia, and Sweden. Of these, the first four correspond in a general way to the pre-war Austria-Hungary, which exported about 322,000,000 cubic feet a year, and was overcutting its forests to do so. In the years just preceding the war, Austria-Hungary was yielding ground as an exporting country to Russia, Finland, and Sweden. In order to maintain their combined exports at the above level, these four countries will have to hold their own consumption down to very low levels, or seriously deplete their forests. They will probably do both for the next decade or two, in order to rehabilitate their finances and economic status, with the result that

TABLE 37.—AVERAGE TIMBER EXPORTS AND IMPORTS, ASIA

Country	Exports	Imports	Excess of	
			Exports over imports	Imports over exports
	M cu. ft.	M cu. ft.	M cu. ft.	M cu. ft.
Afghanistan	....	....	....	....
Arabia	....	....	....	....
British East Indies	1,606	....	1,606	....
Ceylon	437	542	....	105
China	....	13,737	....	13,737
Dutch East Indies	1,514	....	1,514	....
French Indo-China	....	112	....	112
Hongkong	....	4,000	....	4,000
India	1,648	4,373	....	2,725
Japan	36,850	1,230	35,620	....
Malay Peninsula	....	12,500	....	12,500
Mesopotamia	....	....	....	....
Palestine and Syria	....	....	....	....
Persia	1,351	755	596	....
Philippines	543	516	27	....
Russia (Asiatic)	2,000	....	2,000	....
Siam	4,458	....	4,458	....
Turkey	....	....	....	....
Total	50,407	37,765	45,821	33,179
Net exports			12,642	

eventually their domestic needs will absorb all the forests can produce. Norway has very little surplus of structural timber, her exports consisting mainly of pulpwood and pulp, and Sweden's exports are largely of the same character. Finland and Russia then are left as the only two countries in Europe which can be counted on as important sources of structural timbers for the world markets.

The chief importing countries are Great Britain, Germany, France, Italy, Belgium, and the Netherlands. With all of them, imports of timber have been growing by leaps and bounds during the last half century, as their industries have developed. Great Britain imports practically 95 per cent of her entire consumption of wood, and while the proportion is not so great for the others, their imports constitute a very important part of their total supply of timber.

The Baltic States, Esthonia, Latvia, and Lithuania, before the war were important centers of wood-working industries, engaged in the sawing and finishing of Russian timber for the export trade. As their forest resources hardly suffice for their own needs, any future export business that may develop will depend on supplies of raw material from Russia.

In Asia the only country exporting on a fairly large scale is Japan. A few others, Siam, Siberia, North Borneo, Java, Persia, and the Philippines, export small amounts. The rest are self-sufficient, or like Asia Minor and China, depend to a large extent upon imports. India and Ceylon export some timber, but import much greater amounts, and their needs are bound to increase with the development of domestic industries. Within a few years even Japan will need all of her timber, and may have to import some in addition. With the large undeveloped supplies in the southeast, particularly in Indo-China, Borneo, Sumatra, and the Philippines, these countries will eventually become important sources of timber for China, India, southwestern Asia, and possibly other parts of the world. The most important reserve, however, is in Siberia. Of all the Asiatic countries capable of exporting timber, she alone possesses great expanses of coniferous forest. According to rough estimates of the potential production of her forests, Siberia can furnish to the world market about 6 billion cubic feet of softwood timber a year, which is double the quantity now entering international trade, and 30 per cent of the world's consumption of coniferous sawtimber.

In North America, the United States exports the greatest volume of timber, and is the greatest exporter in the world with the exception of Sweden. It is by far the largest exporter of construction timber, for the Swedish trade includes a very large proportion of pulpwood and small timber. The United States, however, imports almost as much wood as it exports, and since 1914 the surplus of exports over imports has steadily decreased until now the two almost balance. Canada has the largest net exports, and the quantity is likely to increase greatly in the future. A large part of the total consists of pulpwood and woodpulp, most of which goes to the United States. Alaska has great reserves of virgin timber in her coast forests, and when fully developed will contribute large quantities to the world trade.

TABLE 38.—AVERAGE TIMBER EXPORTS AND IMPORTS, NORTH AND CENTRAL AMERICA

Country	Exports	Imports	Excess of	
			Exports over imports	Imports over exports
	M cu. ft.	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*
Canada	540,620	99,000	441,620	
Central America:				
British Honduras	875	120	755	
Costa Rica	300	350		50
Guatemala	420	250	170	
Honduras	100	1,000		900
Nicaragua	1,000	50	950	
Panama	140	1,940		1,800
Salvador	25	25		
Mexico	5,000	15,000		10,000
Newfoundland	6,300	0	6,300	
United States	754,000	558,000	196,000	
Alaska	55	50	5	
West Indies:				
British West Indies:				
Bahamas	315	90	225	
Barbados	0	2,300		2,300
Bermuda	0	200		200
Jamaica	2,000	1,500	500	
Leeward Islands	0	250		250
Trinidad-Tobago	150	890		740
Windward Islands	125	200		75
Cuba	4,000	13,500		9,500
Dutch West Indies	0	150		150
French West India	0	1,100		1,100
Haiti	1,500	500	1,000	
Porto Rico	0	5,650		5,650
Santo Domingo	500	670		170
Virgin Islands	0	50		50
Total	1,317,425	702,835	647,525	32,935
Net exports			614,590	

In the southern part of the continent, Mexico has extensive undeveloped forests of pine, and may eventually export considerable quantities, at least for a few decades. Her own requirements are bound to grow, however, and she already imports a great deal of pine lumber. Southern Mexico, Central America, and the West Indies are important sources of cabinet and dyewoods, but import considerable construction lumber from the United States and Canada. Cuba and Porto Rico, which have been developing rapidly during the last 25 years, use particularly large quantities of imported softwoods. Several of these countries have forests more than sufficient for their own needs, including much pine and oak, and they will eventually become timber-exporting nations.

TABLE 39.—AVERAGE TIMBER EXPORTS AND IMPORTS, SOUTH AMERICA

Country	Exports	Imports	Excess of	
			Exports over imports	Imports over exports
	M cu. ft.	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*
Argentina	17,800	45,800	....	28,000
Bolivia	50	1,500	....	1,450
Brazil	6,000	2,900	3,100	....
British Guiana	1,000	650	350	....
Chile	400	4,000	....	3,600
Colombia	200	170	30	....
Dutch Guiana	500	0	500	....
Ecuador	25	100	....	75
French Guiana	50	25	25	....
Paraguay	5,800	0	5,800	....
Peru	15	4,990	....	4,975
Uruguay	0	7,000	....	7,000
Venezuela	200	300	....	100
Total	32,040	67,435	9,805	45,200
Net imports				35,395

South America, which is the best provided with forests among all the continents, imports more than twice as much timber as it exports. Neither exports nor imports are very large, however. Argentina is the leading exporter, because of her heavy shipments of quebracho, and at the same time her imports are twice as great as for all the rest of South America. The next largest importer is Uruguay, followed by Peru and Chile.

Paraguay has the largest net exports, consisting of quebracho for foreign markets and construction timber for Uruguay and Argentina. Brazil exports construction timber, principally Parana pine, to other

TABLE 40.—AVERAGE TIMBER EXPORTS AND IMPORTS, AFRICA

Country	Exports	Imports	Excess of	
			Exports over imports	Imports over exports
	M cu. ft.	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*
Belgian Africa	(1)	(1)	....	....
British Africa—total	2,698	45,786	....	43,088
British East Africa	327	160	167	....
Gold Coast and Ashanti	1,384	346	1,038	....
Sierra Leone	10	210	....	200
Egypt and Sudan	....	24,412	....	24,412
Nigeria	900	900	....	....
Rhodesia (Southern)	34	258	....	224
Union South Africa	43	19,500	....	19,457
Other British colonies	(1)	(1)	....	....
Former German Africa—total	320	60	260	....
Cameroon (French)	314	....	314	....
Togoland	6	60	....	54
Others	(1)	(1)	....	....
French Africa—total	7,879	17,778	....	9,899
Algeria	603	13,102	....	12,499
Dahomey	....	14	....	14
French Congo	4,497	....	4,497	....
Guinea	70	70	....	....
Ivory Coast	1,616	28	1,588	....
Madagascar	303	....	303	....
Morocco	....	1,624	....	1,624
Senegal	....	440	....	440
Tunisia	790	2,500	....	1,710
Other French colonies	(1)	(1)	....	....
Independent States	(1)	(1)	....	....
Italian, Portuguese, and Spanish Africa	(1)	(1)	....	....
Grand total	10,897	63,624	7,907	60,634
Net imports				52,727

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(1) Exports and imports negligible in quantity.

South American countries, and cabinet woods to Europe and North America. Her exports have increased rapidly during the last few years, and will probably become very important in the near future. The Guianas have vast undeveloped resources and will undoubtedly export more and more timber as they are opened up. The northern and western countries, Venezuela, Colombia, Ecuador, Peru, and Bolivia, all have enormous areas of tropical forests, most of which, however, are now comparatively inaccessible not only for purposes of world commerce, but even for supplying their own domestic needs. While they may eventually become timber exporting countries, it will hardly happen within the next several decades.

Although Africa has enormous supplies of timber in her equatorial forests, her exports are the smallest of any of the continents. The bulk of them consist of cabinet woods from the colonies bordering the Gulf

TABLE 41.—AVERAGE TIMBER EXPORTS AND IMPORTS, AUSTRALIA AND OCEANIA

Country	Exports	Imports	Excess of	
			Exports over imports	Imports over exports
	M cu. ft.	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*
Australian Commonwealth:				
New South Wales	1,634	12,242		10,608
Queensland	2,000	6	1,994	
South Australia		7,403		7,403
Tasmania	2,083	336	1,747	
Victoria	75	10,366		10,291
Western Australia	9,099	911	8,188	
Total	14,891	31,264		16,373
New Zealand	6,945	3,214	3,731	
Oceania:				
New Caledonia	1		1	
Hawaiian Islands		8,000		8,000
Fiji		1,000		1,000
All others	Imports	and exports	negligible	
Total	1	9,000		8,999
Grand total	21,837	43,478	15,661	37,302
Net imports				21,641

of Guinea, especially French Congo, Ivory Coast, and Gold Coast. Egypt takes the largest amount of imported timber, and South Africa and Algeria also import considerable quantities. The only others whose timber trade is important are Tunisia and Morocco, importing countries.

TABLE 42.—FOREST AREAS OF EXPORTING, IMPORTING AND SELF-SUSTAINING COUNTRIES

Exporting countries	Acres of forest per capita	Countries whose exports and imports balance	Acres of forest per capita	Importing countries	Acres of forest per capita
Europe:					
Austria	1.2	Esthonia	1.1	Belgium	0.2
Czechoslovakia	0.9	Hungary	0.4	Bulgaria	1.4
Finland	14.7	Latvia	1.2	Denmark	0.3
Jugo-slavia	1.2	Lithuania	1.0	France	0.6
Norway	6.5			Germany	0.5
Poland	0.9			Great Britain	0.1
Portugal	0.8			Greece	0.9
Rumania	1.2			Italy	0.4
Russia	4.4			Netherlands	0.1
Sweden	9.6			Spain	0.8
				Switzerland	0.6
Asia:					
Japan	1.2			China	0.8
Siam	4.0			India	0.6
				Malay Peninsula	7.5
North America:					
Canada	82.3			Mexico	4.8
Jamaica	0.9			Cuba	4.5
Newfoundland	26.3			Porto Rico	0.3
United States	5.2				
South America:				Argentina	32.0
Brazil	32.8			Chile	7.7
Paraguay	46.0			Peru	38.6
				Uruguay	0.7
Africa:				Egypt and Sudan	0.4
French Congo	10.0			Union of South Africa	0.25
				Algeria	1.3
				Tunisia	1.5
Australia and Oceania:				Australia	17.6
New Zealand	16.1			Hawaii	4.0

Although three states of the Australian Commonwealth, Queensland, Tasmania, and Western Australia, export more timber than they import, the country as a whole is an importer. New Guinea, and probably the Northern Territory of Australia, have great potential resources of tropical woods, but their forests are still unexplored and undeveloped. New Zealand, which has been the only Australasian country to export conifer timber, has seriously depleted her supplies, and with the present restrictions on export trade will soon become an importing country.

The various countries whose timber trade is relatively important are grouped in Table 42 according to whether their exports or their imports are the greater.

Both the exports and the imports of the countries listed above comprise 99 per cent of the totals for the world, the remaining one per cent being divided among all the others.

It will be noticed that excepting Bulgaria, Greece and Spain, whose forests have been greatly abused and are not producing the amount of timber they are capable of growing, the importing countries of Europe all have less than 0.8 acre of forest per inhabitant. Except for Hungary, which probably should be classed as an importing country in the long run, all the other countries with 0.8 acre or more per capita have wood sufficient for their own needs, or surpluses for export. Those with more than about 1.2 acres per capita are definitely exporting countries. Practically the same figures hold for the more developed populous Asiatic countries.

In the other continents, however, where the forests have been very little exploited because of lack of population or transportation facilities, or where they have been regarded as timber mines rather than as sources of regular timber crops, there is as yet very little relation between forest areas and exportation or importation of wood. Countries like Canada, United States, Australia, and New Zealand will definitely become importers of timber long before their forest areas are reduced to 0.8 acre per capita, because their normal consumption of wood is much greater than that of Europe. Even with their forests handled so as to produce continuous crops, they will probably need from three to four acres per capita to remain self-sufficient. As far as timber supply is concerned, the countries in the humid tropical regions, on the other hand, can do with even less area of timber land than can Europe, because the potential growth of wood per unit area is much greater, and per capita needs for wood are much less than in Europe. Even allowing for a greatly increased rate of consumption, from 0.3 to 0.5 acre of well-managed tropical forest per capita should be ample to meet domestic requirements.

A LOOK INTO THE FUTURE

Reduction in the areas under forest will undoubtedly continue in the future as it has in the past, as increasing population requires more and more land for agriculture, and as the forests in many regions continue to be destroyed by fires and cutting, without provision for their renewal. Even in many of the older countries, where the forests are appreciated and well cared for, considerable areas are cleared each year for agricultural use. Further increases in the area of farm land in most countries must come to a large extent from land now occupied by forests. Here and there, as in France, Belgium, Holland, and Germany before 1914, the forest area has been slowly increasing through planting, while in other places, as in the northeastern and southeastern parts of the United States, there is taking place a gradual natural reversion to forest of worn-out farm lands, yet these increases are very small in the aggregate, in comparison with the reductions in other places.

At the first glance, there appears to be no reason for concern regarding this steady but gradual diminution of the area of forests that is taking place in almost all parts of the world. There are still 4.4 acres of forest for each person in the entire world, capable of producing many times the present requirements for wood, which amount to only 32.5 cubic feet per capita per annum, or 7.5 cubic feet per acre of forest. To be sure, some countries which have had plenty of timber of their own may use it all up and have to seek elsewhere for their supplies, and others which hitherto have used but little timber may enter upon an era of development and require large amounts, yet there still remain great reserve supplies of practically untouched forest, in Siberia, in equatorial Africa, in southeastern Asia and nearby islands, and in the basin of the Amazon in South America.

Before the development of means of cheap transportation, bulky commodities like timber could not be marketed at great distances from the points of production, and it was necessary for a country to depend on its own forests for wood or do without. Now, however, the world is covered by an intricate and constantly expanding network of transportation systems—highways, railroads, canals, and steamship lines—and lumber is shipped from one side of the world to the other. Countries with little timber of their own can easily get it from others which have a surplus. China obtains large amounts of lumber from North America, and South Africa gets much of hers from northern Europe.

Siberia, with over a billion acres of forest, if fully developed could export 6 billion cubic feet of timber a year, an amount equal to almost one-fourth of the total world consumption of sawtimber, while the tropical forests are capable of vastly greater production. The amount of standing timber in the Amazon basin and adjacent parts of South

America, for instance, has been estimated at approximately 3,400 billion board feet, or possibly 750 billion cubic feet of sawtimber besides a large quantity of smaller material. The tropical rain-forest of Africa, covering more than 350 million acres, with that of Asia and the East Indies, nearly 500 million acres, and that of South America, more than 1,000 million acres, could if fully developed and only moderately well handled produce continuously the enormous amount of from 200 to 250 billion cubic feet of wood a year, which is equal to four times the present world consumption.

There are several reasons, however, for not feeling entirely satisfied with the situation. In the first place, it will be a great many years before the tropical forests are able to supply a large part of the world's requirements for wood, if they ever can. Before they can do this, they must be opened up by adequate systems of cheap transportation, and adequate supplies of efficient labor must be at hand both to construct the transportation facilities and to exploit the timber. This means a fairly large population, of races accustomed to or easily adaptable to carrying on woods work on a large scale. Such a population is not now present in most of the tropical forest belt.

Another difficulty which must be overcome is the nature of the tropical forests themselves. They are mostly composed of a very great variety of species, intermingled in the greatest confusion, and can be exploited economically only if practically all the important species can be utilized. Only a few of them are known on the world markets, and those are chiefly cabinet woods, of which the supply and the possibilities for utilization are more or less limited. In order to dispose in the general market of large quantities of the less known timbers, particularly those which are more suited for common lumber and construction, a long process of education and economic pressure will be necessary to overcome the established habits and idiosyncrasies of the consuming nations.

When development of the tropical forest industry does take place, it will be accompanied by other phases of development which will have an important bearing on the general problem. In the first place, the tendency in all new countries is to try to hasten development by all sorts of inducements to private exploiters, such as concessions of public lands and forests, and a large measure of freedom from restrictions as to their use of the resources. A very large proportion of the tropical forests may be expected to pass into private ownership, and to be exploited just as wastefully as have the forests of all other regions under similar circumstances. Not only will large quantities of the standing timber be destroyed without being utilized, and large areas of land now bearing valuable timber be turned into worthless brush-lands, but vast areas will perfectly legitimately be cleared for farming and other use.

To support only the population required to develop the forests will require a large area of agricultural land, and as much of the tropical forest is on land eminently suited to agriculture, it is to be expected that general agricultural development will accompany the exploitation of the forests. At the same time, in many of the tropical forest regions or near them are other valuable natural resources, such as minerals and water power, whose exploitation will mean a still further increase of population and industries. All of these will mean an enormous increase in the domestic consumption of wood.

Meanwhile the forests will continue to be reduced in area, and the quality of those remaining will tend to deteriorate, until the timber resources become so badly depleted that steps are taken to prevent further destruction and to build them up on a permanent basis. The history of forestry in most countries shows that effective steps toward forest regulation are seldom taken until a country's forest resources have become so depleted as to make it anxious regarding its own future supplies of timber. It is very doubtful, then, whether the equatorial forests can be counted on to supply a large part of the timber needed by the northern countries.

Another point that must be taken into account is the steady increase in the world's requirements for timber. Of the 56 billion cubic feet a year consumed now, 30 billion feet is for fuel. About three-tenths of the wood fuel is used in tropical countries, the rest in temperate regions, and the total is equivalent in heating value to from 250 to 300 million tons of coal. This is about 20 per cent of the world's consumption of coal. The use of wood fuel tends to decrease, but this decrease is more than offset by the increased rate of consumption of other timber. As fast as some uses of wood are dropped in favor of substitutes, others arise. Examples of comparatively new and rapidly growing uses for wood are paper pulp, railroad ties, telephone and telegraph poles, and wood paving. The consumption of wood other than fuel, if it continues to increase at the rate of the last few decades, will double in 50 years, and there is no reason to believe that it will not continue to increase after that.

Of the present consumption of wood other than fuel, three-quarters is from coniferous forests and about one-fifth from temperate hardwood forests. The temperate hardwoods are on better soils than the conifers, for the most part, and are chiefly in the more densely populated regions where the pressure for agricultural land is strongest and most persistent. Moreover, after the original hardwood forests are cut over there is a tendency to cut over the second-growth stands for firewood and for various minor products before they reach sawtimber size, with the result that further sawtimber production from second-growth hardwood stands will not be very important, even if the wood were in as great demand as that of the conifers.

The crux of the world's timber supply problem during the next two or three generations, at least, is the conifer forests. Whether they will be able to meet the demands depends upon what steps shall be taken during the next few years to put them on a permanently productive basis. There are slightly more than 2,500 million acres of coniferous forest including several hundred millions of very low productive value. The present growth of conifer timber is not quite 80 per cent of the present cut, therefore it is evident that the forest capital is being steadily depleted. Moreover, large areas of coniferous forest are being rendered incapable of further growth, temporarily at least, after being cut over. This is taking place in some sections of the United States, as well as in other countries.

There are several hopeful factors in the situation, however. The potential growth of the existing conifer forests, if they could be put under careful management, is probably three times the present cut. As most of these forests are in general on the poorer lands—either on the poorer soils or high in the mountains or in the far north where population is comparatively sparse and agriculture by itself not especially successful, they are less likely to be greatly reduced to make room for farming than either the temperate or the tropical hardwoods. Given a proper desire for their maintenance on the part of their owners, there is no reason why the area under conifers should not remain almost as large as it is now. In some regions it might even be extended by planting, as was done in the Landes of France, and as is now being done in such countries as Australia and Chile. Another favorable factor is the fact that due to their location on poorer or less accessible lands, there is a tendency for a large part of the areas under coniferous forest to remain in or return to public ownership, or else to be held by large corporations such as pulp and paper companies for the definite purpose of continuous timber production. Moreover, in most countries possessing coniferous forests the appreciation of their value and economic significance is becoming general, and will undoubtedly prove a powerful factor in maintaining them permanently in a condition to supply the world's needs.

CHAPTER II

THE FOREST SITUATION IN EUROPE

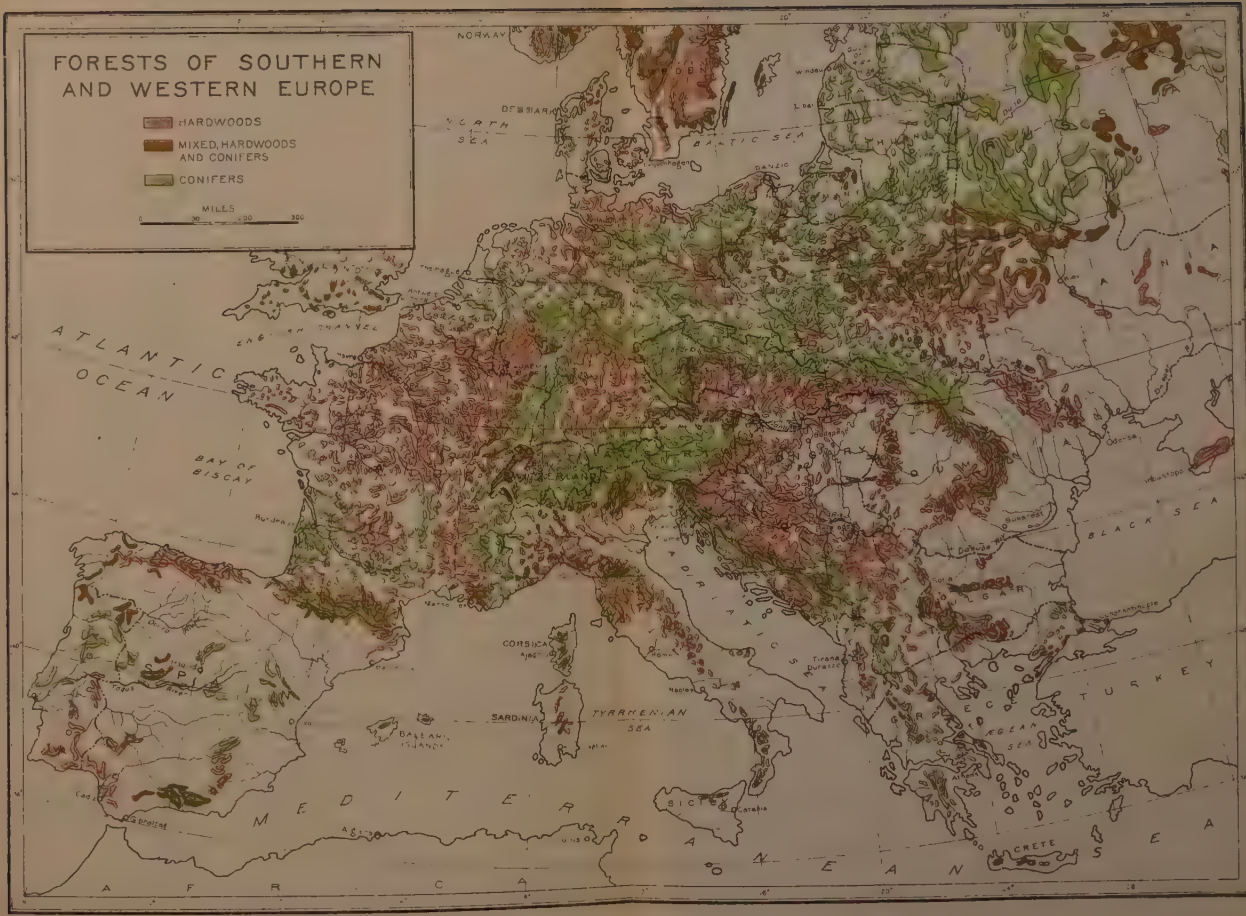
AUSTRIA

Forest Area.—Before the war Austria-Hungary was the greatest wood exporting country in the world. The combined forest area of Austria, Hungary, and Croatia and Slavonia, together with the provinces of Bosnia and Herzegovina, was about 53,000,000 acres, or 30.24 per cent of the total land area. In 1910 the forests of Austria alone comprised 24,127,676 acres, or 32.6 per cent of the land area. The provinces which composed Austria before the war and their forest areas were as follows:

Table 43.—Forest Area of Austria

Province	Total land area	Area of productive land	Total forest area	Per cent of forest	
				Of the total land area	Of the productive land area
	acres	*acres*	*acres*		
Lower Austria	4,893,564	4,723,134	1,690,977	34.6	35.8
Upper Austria	2,959,307	2,739,230	1,004,687	34.0	36.7
Salzburg	1,764,568	1,458,535	582,041	33.0	39.9
Styria	5,539,222	5,156,372	2,592,467	46.8	50.3
Carinthia	2,550,769	2,319,330	1,126,705	44.2	48.6
Carniola	2,459,132	2,349,711	1,091,658	44.4	46.5
Coast Region	1,967,849	1,835,951	578,484	29.4	31.5
Tyrol with Vorarlberg	7,231,172	5,905,770	2,729,547	37.7	46.2
Bohemia	12,830,662	12,356,175	3,800,041	29.6	30.8
Moravia	5,488,834	5,272,215	1,539,998	28.1	29.2
Silesia	1,271,062	1,228,578	442,207	34.8	36.0
Galicia	19,388,759	18,824,858	4,924,928	25.4	26.2
Bukowina	2,577,939	2,484,820	1,081,191	41.9	43.5
Dalmatia	3,177,902	3,109,236	942,745	29.7	30.3
Total	74,100,141	69,763,915	24,127,676	32.6	34.6

Styria thus possessed relatively the largest forest area, or half of its total productive land area. It was followed by Carinthia and Carniola,



FORESTS OF SOUTHERN AND WESTERN EUROPE

Tyrol and Bukowina. The least forested province was Galicia, where only one-fourth of the total land area was under forest.

Today Austria comprises only Lower Austria, Upper Austria, Salzburg, Vorarlberg, and the northern German regions of Styria, Carinthia, and Tyrol. In addition to these are portions of the Hungarian counties bordering on Lower Austria and Styria, the boundaries of which have not yet been determined. Exclusive of these west Hungarian areas, Austria has an area of 20,175,000 acres, with 6,146,000 inhabitants. The forests occupy about 7,600,000 acres, or 37.7 per cent of the total land area. The per capita forest area is 1.24 acres.

Character of the Forest.—Before the war the forests consisted of about 60 per cent conifers, 20 per cent broadleaf species, and 20 per cent mixed conifers and hardwoods. The present proportion of conifers to hardwoods is probably the same; if any change occurred at all it was to increase the proportionate area of conifers. Spruce and beech are the two principal commercial trees of Austria. Spruce is distributed almost uniformly over the entire forest area. Black pine (*Pinus laricio austriaca*) occurs in Lower Austria; fir (*Abies pectinata*) occurs in considerable quantities in Tyrol. Of the hardwoods, next to beech, oak is the principal species; it forms pure stands in Lower Austria.

By methods of management the forests in Austria were distributed before the war as follows:

	Per cent
High forest managed on a clear-cutting system	58.3
High forest managed as selection forest	27.5
Coppice	11.9
Coppice with standards	2.3

This proportion probably holds good for Austria today, because high forest was the common practice in Upper and Lower Austria and in the mountainous forests of Tyrol and Vorarlberg, provinces which enter into the present boundaries of Austria. If any change occurred at all it was in favor of increasing the percentage of high forest managed on a selection and clear cutting basis, because coppice with standards was particularly developed in Galicia and the sea provinces, and coppice was predominant in Dalmatia and in the sea provinces. None of these are now parts of Austria.

Character of Ownership.—The forests of Austria are owned as follows:

	Acres	*Per cent*
State	967,005	12.7
Private	4,895,540	64.4
Communities, churches, and religious foundations	1,736,904	22.9

Annual Growth.—Considering that before the war the average annual increment in Upper and Lower Austria was 51.4 cubic feet per acre, in Salzburg 34.3, in Styria 45.7, and in Tyrol 28.6, the present annual growth for Austria is probably not more than 35 cubic feet per acre, or for the present forest area 265,000,000 cubic feet, of which 50 per cent is large saw timber.

Annual Cut.—Before the war the annual cut was from 60 to 67 cubic feet per acre. Since the average growth per acre was estimated at 35 cubic feet, it is evident that at this rate the forests were overcut. The potential production of construction timber alone in present Austria is estimated at 132,500,000 cubic feet annually, or 17.4 cubic feet per acre.

Domestic Consumption.—The consumption for Austria-Hungary before the war was in the neighborhood of 57 cubic feet for each inhabitant. It is impossible to tell what the present consumption is. As Austria has lost many of its wood-using industries, its per capita consumption for some time will not exceed 35 cubic feet, or about 215,000,000 cubic feet in all. At such a rate of consumption, Austria ought to have an excess production of wood of 50,000,000 cubic feet available for export. The tendency, however, will be to force cutting to the limit, since timber export is the greatest factor in the trade balance. Of the 215,000,000 cubic feet used at home, 38 per cent will consist of construction timber.

Imports and Exports.—The export trade will be confined to softwoods, and Austria may depend on imports of hardwoods from Jugoslavia for her domestic industries. In view of the present low value of the Austrian crown this is a very serious drawback to the Austrian wood-working industry. In spite of many hindrances to the lumber trade and special regulations governing exports, lumber will continue to be one of the chief items of export.

Two forest regions are concerned in the timber trade: the Alps region and the region of the Böhmerwald.

1. *The Alps Region.* This furnishes chiefly spruce in the form of round timber, pulpwood, and sawed lumber. In normal times these products were shipped from the Mur north to Germany, and from the central and southern Alps to Italy and the other countries of the Mediterranean region.

The wood from the central Alps is comparatively close-grained and of uniform growth, of fairly large dimensions, and not liable to crack. Norway spruce and larch grow to very large sizes in the Alps, but larch is in demand at present only in the markets of Trieste and Italy. Cembran pine, which is much in demand for furniture, flourishes in the high mountains of the central Alps. Fir is sold with Norway spruce, but brings from 10 to 20 per cent less. Beech is very abundant in the northern and southern Limestone Alps. In the northern part of the region it produces chiefly fuelwood, while in southern Styria the uniformly large dimensions of this species make it the basis of an extensive hardwood industry. Maple is now scarce in this region. Ash is abundant in the river bottoms. In spite of the large number of rivers in the Alps region, they are very little used for timber transportation. The tendency of trade is toward the north (Germany) and the south (Italy), while the river system of the Danube extends toward the east, where timber is abundant. The Danube does serve to some extent, however, for transporting sawed lumber to Bavaria.

Considerable building timber, lumber, and fuelwood are also floated on the Enns, the Traun, and the Danube from the Alps of Upper and Lower Austria to Vienna. The remainder of the traffic is carried almost entirely by rail.

The wood trade of Salzburg, Upper Austria, and Upper Styria is carried on chiefly with Germany and Switzerland. The woods most in demand are heavy building timber, pulpwood, railway ties, and sawed lumber. When the demand is heavy, the trade is extended to include Lower Austria and Carinthia, where Germany must compete with the Mediterranean countries on the market. Switzerland also buys some timber in the Tyrol, which has not much wood to export.

The Mediterranean countries, especially Italy, buy wood in the Tyrol, Carinthia, and Styria. The demand is chiefly for sawed timber of all kinds, in addition to hard and soft round timber.

About 11 per cent of the forests of the Alps region are owned by the government, and the remainder by the communes and by private individuals. Thus small forest holdings predominate. It is common in the latter forests to sell wood on the stump, the buyer taking the responsibility of removing the timber. Larger owners also prefer to sell in the forest, but they cut and work up the wood at their own expense, so that the finished commodity forms the object of the transaction.

2. *Böhmerwald.* Above and below Enns north of the Danube are spurs of the Böhmerwald. This mountain range still contains primeval forest consisting chiefly of Norway spruce. Timber production and trade in this region follow about the same trend as in the neighboring province of Bohemia although part of the wood, especially logs, sawed lumber, and fuel, is shipped by way of the Danube to Vienna, and part goes to the same destination by land. Bavaria also takes some of the pulpwood and sawed lumber.

3. If the German-Hungarian counties of Odenburg, Eisenburg, and Wieselburg are added to the Republic of Austria, the latter will gain 563,160 acres of forest, of which 60 per cent is broadleaf timber, mostly

beech. This area can produce enough timber for home use, but none for export.

Wood-Using Industries.—The sawmill industry is widespread in Austria. The abundant water power favors the establishment of a large number of small mills, though these are gradually decreasing on account of the heavy competition on the market. It is likely that consolidation of these small enterprises into larger units will improve production.

In addition to sawmills there are many other wood-using industries, such as wood pulp and cellulose mills, which frequently come into competition with foreign timber dealers.

Charcoal manufacture can no longer be carried on to any great extent except in the beech region, especially in southern Styria. In the coniferous regions this industry has had to yield to the heavy demand for pulpwood.

Aside from round timber and pulpwood, most of the trade is in partly manufactured articles, especially sawed stock.

Forest Laws and Education.—In the past Austria had a very efficient organization for handling public forests and very rigid laws relating to the management of private forests in certain protection zones. What care the forests will receive under the new régime will depend to a large extent upon the available funds and the general attitude toward forest conservation. It is safe to assume, however, that within the near future the forests will be largely sacrificed for the sake of larger returns from them. In the past the higher forest personnel was trained at the Agronomical Institute at Vienna and the lower forest personnel at several ranger schools. At present forest education is being hampered by lack of state funds.

Probable Future.—Austria, even with its reduced forest area, because of the smaller population will be capable of producing more timber than it will actually need for its own use. It has ceased to be one of the great exporting countries of the world, however, its place having been divided among several countries such as Jugo-slavia and Czechoslovakia.

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BELGIUM

Forest Area.—The present forest area of Belgium is 1,321,243 acres, forming 18.2 per cent of the total land area, or 0.2 acre per inhabitant. The most heavily wooded provinces are Luxemburg, 41 per cent, and Namur, 31 per cent, which together comprise 666,937 acres. The present forest area has somewhat increased over that of 1846, as may be seen from the following: 1846, 1,200,269 acres; 1866, 1,074,057 acres; 1880, 1,299,557 acres; 1895, 1,303,735 acres; and 1906, 1,321,243 acres.

Character of the Forest.—Of the total forest area, 71.1 per cent is hardwood growth and 28.9 per cent is coniferous (pine predominating). Of the hardwoods 56 per cent is managed as composite forest, 31 per cent as sprout forest, and 13 per cent as high forest. Especially common is oak coppice wood, managed for bark, the annual production of which amounts to about 29,500 tons.

Character of Ownership.—By ownership the forests are distributed as follows:

	Acres	*Per cent*
Private forests	818,360	61.94
Public institutions	15,809	32.31
Communes	411,110	
State forests	75,964	5.75

Thus most of the forests of Belgium are privately owned. In 1815 the area of state forests comprised 180,310 acres, but by successive sales it has been reduced until in 1884 it amounted to only 61,750 acres. Since 1884 the sale of state forests has stopped and a reverse policy has been adopted, namely, a gradual acquisition by the state of forests and waste land which could be converted into forest. The area of state forests has thus increased from 63,092 acres in 1900 to 75,964 in 1905. All communal and institutional forests more than 12 acres in extent and not more than 0.62 mile distant from a forest which is already under state supervision come under state control. The total forest area under state supervision, including state, communal, and institutional forests, amounts to 502,883 acres or 38.06 per cent of the total forest area. These 502,883 acres are distributed according to method of management and species as follows:

	Acres	*Per cent*
Hardwood high forest	67,838	14
Coniferous high forest	115,175	23
Composite forest (coppice with standards)	195,453	39
Coppice	112,742	22
Young plantations	11,675	2

Thus, of all the forests under public supervision, 75 per cent, or

TABLE 44.—IMPORTS AND EXPORTS OF FOREST PRODUCTS—BELGIUM

	1909			1913		
	1 Imports	2 Exports	3 Excess of imports over exports	4 Imports	5 Exports	6 Excess of imports over exports
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
1. Oak and walnut in round logs	1,371,158	114,054	...	1,893,810	72,577	...
2. Oak and walnut—hewn	53,938	65,693	...	58,280	22,204	...
3. Oak and walnut—sawn	5,428,434	52,915	...	5,780,199	85,461	...
4. Construction timber except oak and walnut—round	13,887,055	177,594	...	12,225,131	178,794	...
5. Construction timber except oak and walnut—hewn	1,415,742	29,193	...	1,700,154	34,735	...
6. Construction timber except oak and walnut—sawn rough	33,323,659	260,620	...	39,549,449	674,301	...
7. Construction timber except oak and walnut—planed	109,677	28,346	...	62,869	34,029	...
8. Wood for cabinet work except oak and walnut—round	221,154	8,825	...	346,893	19,980	...
9. Wood for cabinet work except oak and walnut—sawn rough	81,755	1,906	...	153,414	4,589	...
10. Wood for cabinet work except oak and walnut—planed	47,584	3,989	...	32,052	...	...
11. Props, posts, and other timber with a butt diameter less than 9.4 inches	20,535,669	437,967	...	17,579,541	532,889	...
Total	76,475,825	1,181,102	75,294,723	79,381,792	1,659,559	77,722,233
12. Firewood and pulpwood	2,150,220	421,070	1,729,150	2,979,322	361,668	2,617,654
Total	78,626,045	1,602,172	77,023,873	82,361,114	2,021,227	80,339,887
	metric tons	*metric tons*	*metric tons*	*metric tons*	*metric tons*	*metric tons*
13. Dyewood	30,465	10,574	...	34,965	10,972	...
14. Charcoal	404	4,772	...	415	5,550	...
15. Tanbark	10,414	11,320	...	11,170	3,823	...
Total	41,283	26,666	14,617	46,550	20,345	26,205
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
16. Wood pulp	20,669,199	4,780,004	15,889,195	23,369,466	3,916,873	19,452,593

three-fourths, are made up of high and composite forests, capable of producing sawlog material.

Annual Cut.—The annual cut is estimated as 75,789,000 cubic feet, or 57.4 cubic feet per acre, of which sawlog timber forms about 38 per cent, or 28,734,200 cubic feet. In addition some 7,415,000 cubic feet is obtained annually from trees grown outside of forests, making the total cut 83,204,000 cubic feet.

Annual Growth.—During recent years Belgium has manifested a strong tendency not only to husband her forests rationally, but also to increase the forest area. The annual cut, 57 cubic feet per acre, may therefore be taken as the annual growth. There are no recent figures regarding the productivity.

Domestic Consumption.—Home production is unable to satisfy the needs of the country. Belgium depends, therefore, upon large importations from abroad. The excess of imports over exports of all kinds of wood, including firewood and pulpwood, in 1913 amounted to over 80 million cubic feet. The total consumption thus amounts to 163,500,000 cubic feet, or 22 cubic feet per capita. Of this 106,500,000 cubic feet, or 14 cubic feet per capita, consists of sawlog timber while 57,000,000 cubic feet, or 8 cubic feet per capita, is cordwood. If to this be added wood pulp, 19,000,000 cubic feet, the total per capita consumption would be 24 cubic feet.

Exports and Imports.—The exports and imports of Belgium of the different kinds of wood for 1909 and 1913 are given in Table 44.

The chief items of import are construction timber, props, posts, and other small round timber. The total imports—building timber actually used within the country and not reexported—amounted in 1909 to 76,476,000 cubic feet, while the exports of the same material of Belgian origin or manufactured in Belgium and not mere reexports, were 1,181,000 cubic feet, an excess of imports over exports of about 75,295,000 cubic feet. The imports from the different countries are shown in Table 45.

The import of timber into Belgium takes place almost exclusively by sea. A small amount of forest products enters Belgium by transit from Holland and by rivers and canals from Rotterdam and Amsterdam. A small amount is also imported from France and Germany. The chief sea ports through which the import trade of forest products takes place are: Antwerp, Ostend, Ghent, Nieuport, Brussels, Bruges and Zeebrugge, and Selzaete. Table 46 gives an idea of the extent of import and export trade in forest products that passes through these sea ports.

These figures give a picture of Belgian import and export of forest products by sea. The import is growing very rapidly. The total import in 1907 amounted to 1,704,879 metric tons, while in 1909 it increased to 1,815,220. In 1907 the value of the imported timber amounted to

$35,744,064, while in 1909 it increased to $38,038,294. In 1880 Belgium imported forest products valued at about $10,887,000; in 1890, $13,370,000; in 1900, $25,669,000; in 1909, $36,863,000. Thus the value of the import of timber into Belgium increased 3½ times during the twenty-nine-year period. The kind of timber that is imported most is sawed lumber or boards. In 1909 the import of sawed lumber formed 46 per cent of the entire quantity of timber imported and 60 per cent of its value. The import of props and poles comes next, followed by round

TABLE 45.—IMPORTS BY COUNTRIES OF ORIGIN—1909

Country	Sawtimber	Firewood and pulpwood	Wood pulp	Total	Per cent
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	
Russia	43,544,315	251,376	2,274,947	46,070,638	46.4
Norway	4,322,767		10,194,541	14,517,308	14.6
France	8,549,379	1,290,758	44,716	9,884,853	10.0
Sweden	5,457,592		3,899,422	9,357,014	9.4
Holland	5,615,912	472,135	133,025	6,221,072	6.3
United States	5,275,620		760,069	6,035,689	6.1
Germany	2,124,389	71,154	2,732,690	4,928,233	5.0
Austria-Hungary	539,525		217,011	756,536	0.8
Luxemburg	311,099	18,671		329,770	0.3
Great Britain	189,102		49,641	238,743	0.2
Australia	142,435			142,435	0.1
Others	403,691	46,126	363,137	812,954	0.8
Total	76,475,826	2,150,220	20,669,199	99,295,245	100.0

Nearly 50 per cent of all timber imports came from Russia.

TABLE 46.—EXPORTS AND IMPORTS THROUGH BELGIAN PORTS

Port	Import	Value	Export	Value
	metric tons		*metric tons*	
Antwerp	769,120	$20,599,270	67,355	$ 2,246,485
Ostend	137,854	3,820,181	114	798
Ghent	429,031	8,065,675	2,690	41,536,550
Nieuport	4,062	163,807	15	314
Brussels	6,661	140,921	251	6,207
Bruges and Zeebrugge	314	7,314		
Selzaete	3,386	109,762	85	1,839

timber and wood pulp. The chief export is wood pulp, which amounted in 1909 to 27,082 tons, valued at $1,487,042. Tanbark and dyewoods are next in importance.

Wood-Using Industries.—According to the latest available industrial statistics of Belgium there were 325,965 industrial plants utilizing 628,254 horsepower. The wood-using industries were represented by 38,713 plants employing 88,526 persons, or 8.1 per cent of the industrial population of the country. The wood-using industries utilized 7,250 horsepower. The largest number of workmen are employed in cabinet making in the provinces of Brabant, East Flanders, and Hainaut. The furniture industry is especially developed in Hainaut, Brabant, and Antwerp. The cabinet-making and furniture industries conduct 17,641 factories and employ 22,883 workers. According to the amount of power utilized, the sawmill industry occupies the first place. There are 271 sawmills, utilizing in the aggregate 3,513 horsepower. The largest sawmills and the largest number—19, with an average motive power of 33 horsepower—are located in Antwerp. They are engaged chiefly in the resawing of the large hewn logs imported into Belgium by sea. Notwithstanding the large number of steam sawmills, there is still a considerable amount of whipsawing. Thus in Brabant there are 605 hand sawyers of lumber; in East Flanders, 443; in West Flanders, 355; in Hainaut, 218, and in Antwerp, 216.

The production of wooden shoes (sabots) is still confined largely to East Flanders and Hainaut, and gives occupation to about 6,437 workers. The production of wooden shoes is practically limited to the suburbs of St. Nicholas (East Flanders). Native poplar, as well as aspen imported from Russia, is being used for the manufacture of sabots. Russian aspen is also used in the match industry in East Flanders, Antwerp, and Hainaut. The center of the match industry is Grammont. Aspen is imported in sections having a diameter of 14 inches and a length of

TABLE 47.—BELGIAN REVENUE FROM FOREST LAND

Ownership	Total		Per acre	
	Gross revenue	Net revenue	Gross revenue	Net revenue
State forests	$189,967	$125,825	$2.50	$1.66
Communal forests	936,748	753,338	2.28	1.83
Forests belonging to public institutions	68,360	51,045	4.32	3.23
Total	$1,195,075	$930,208	$2.38	$1.85

7.2 to 7.5 feet. Often the sections are as long as 28 or 33 feet. Native aspen is used for the manufacture of match boxes, although its wood is considered inferior to the Russian aspen because of its yellow color.

Revenue per Acre.—The revenue per acre of forest land under state supervision in 1905, the last year for which statistics are available, is shown in Table 47.

The state forests include large areas of waste land still in need of reforestation; also young stands artificially planted, and finally mature stands which cannot be cut on account of their aesthetic value (Spa, Hertogenwald, Soignes).

The productive forest area of state forests therefore barely exceeds 54,340 acres. If the revenue is applied only to the productive forest area the gross revenue per acre becomes $3.50 and the net revenue per acre $2.32. The expenditures in state forests are distributed as follows:

	Per cent
Land tax	1
Costs of selling timber	6
Administrative expenditures	28
Forest improvement	65

The reason for such a high expenditure for improvement is that a great deal of work is done in Belgian forests for aesthetic purposes, for instance building trails, benches, little bridges, artificial lakes, and so on. Of the forests under public supervision, the most valuable ones are those belonging to public institutions. The average sale price of one acre of such forests in 1905 was $73.45, while that of state forests was only $36.96, and of communal forests $36.33. The communal forests comprise large areas of steep slopes, coppice, and young plantations.

The administration of all public forests is in charge of the Department of Agriculture and Interior. The forests are divided into 26 units; the average area of an administrative forest unit is 17,290 acres. There are, however, forests which have a much larger area. Thus Gedinne has 31,820 acres; Barillon, 29,270 acres; Hubert, 28,750 acres; and Couvin, 28,185 acres.

Forest officers beginning with the grade of garde général are appointed and discharged only by the King's order. The lower forest officers are appointed by the Secretary of Agriculture and Interior.

Forest Education.—Higher forest education was originally centered in the forest institute of Bouillon (Ecole forestière supérieure). This institute, however, lasted only four years, from 1864 to 1868. For a long time the Belgian government trained its higher forest officers at Nancy, France. In 1898, however, forest departments were opened at the three agronomic institutions. Two of these are state schools: Gembloux (French language), Ghent (Flemish language); the other a free school located at Louvain (French language). These institutions offer a four-year course in forestry, the graduates receiving the diploma of forest engineer (ingénieur forestier). Those who receive the diploma and pass a competitive examination are appointed as assistant foresters (garde général adjoint). There is also a forest research station at Groenendael.

Forest Laws.—There are no laws restricting the right of usage in private timberlands. Private timber owners are not restricted in the amount of cut nor in the conversion of forest land to any other form of use if they find it advantageous, except in forests which have a public importance because of their hydrologic, hygienic, or aesthetic value.

Probable Future.—Although Belgium is a country of intensive agriculture and land is valued very high, the area of unproductive land, particularly swamps and heath, is still very large. There is about 353,000 acres of waste land which is in need of afforestation. This includes nearly 5 per cent of the total land area. Thus, about one-twentieth of Belgium is waste land which can gradually be turned into productive forests. This waste land, by provinces, is distributed as follows:

	Acres
Luxemburg	135,919
Limburg	97,291
Antwerp	93,996
Liége	25,967
	353,173

When Belgium has reforested all of her waste land—353,000 acres—the forests will occupy 23 per cent of the entire land area. This, however, will not happen soon. Meanwhile the population is growing, the demand for new houses is increasing, industry is developing, and the demand for wood is growing. Belgium is thus destined for a long time to meet its needs for wood by importations from abroad. The chief provider of Belgium will continue to be Russia.

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BULGARIA

Forest Area.—At the close of the Balkan wars in 1913, the total forest area of Bulgaria was 7,515,000 acres, or approximately 28 per cent of the area of the country. This represents about 1.4 acres per capita of the population. The coastal territorial losses sustained by Bulgaria by the terms of the treaty of Neuilly in 1919 did not affect essentially the prewar extent of the forests, because of their location in the mountains in the interior.

The Bulgarian forests are valued at 125 million dollars. Considering its population, Bulgaria is thus richer in forests than Italy, Rumania, Spain, Portugal, or Greece, and vastly better off than Hungary.

Character of Forest.—Most of the forested land of Bulgaria lies in the mountains, principally in the eastern Balkan range and the Rhodope and Rilo mountains. The spurs of the western Balkans toward the Serbian frontier are all under agriculture. The plains region contains scattered groups of forest, such as the Deli Orman and the Longus and Genisch-Ada forests on the coast of the Black Sea, the last two covering about 75,000 acres. The percentage of forested to total area varies between 4 per cent in Szwischtow, and 90 per cent in Peschtera in the Rhodope mountains.

Broadleaf species far outnumber conifers, constituting about two-thirds of the total forested area. Broadleaf trees are especially abundant in the Balkan range, where spruce and fir are subordinate species. The forest flora closely resembles that of eastern Europe, though, owing to the southern latitude of the country, it might rather be expected to resemble that of the Mediterranean region. The forests fall naturally into the following more or less distinct zones:

1. In the hill and plains forests the chief species is oak (*Quercus sessiliflora, pedunculata, conferta,* and *cerris*), with hornbeam, ash, maple, aspen, and basswood. Walnut is abundant in eastern Rumelia. The oak forests of the lower regions consist principally of *Quercus conferta* mixed with *Quercus cerris*. *Quercus pedunculata* is found only in the river bottoms. Really fine oak forests are unfortunately of rare occurrence in Bulgaria, owing to the fact that most of the forests of this species are owned by the communes, and sheep and goat grazing has reduced them almost completely to scrub. In the state forests of Longus and Genisch-Ada, however, there are still fairly good specimens of oak and ash, and although *Quercus conferta* does not reach its largest dimensions here its timber is of good quality.

2. At 2,600 to 2,900 feet above sea level beech becomes the predominant species, with occasional admixture of pine and fir. This region at one time contained vast forests, but they have been cut to make way for agriculture, and now consist principally of brush and scrub, which

supplies the demand for fuel and charcoal. Some large timber trees still remain in the less accessible parts of this region.

3. The middle belt, up to 4,300 feet above the sea, is chiefly beech, mixed here and there with ash, plane, oak, and hornbeam. This forest is difficult of access, and has therefore been little exploited.

4. As the forest ascends the Rilo and Rhodope ranges between 4,300 and 6,500 feet above sea level, its character changes. Beginning with beech mixed with conifers, the latter gradually become predominant, and include *Pinus sylvestris*, *Picea excelsa*, *Pinus laricio*, and *Pinus mughus*. In the upper region the rare *Pinus peuce* (Rumelian or Macedonian pine) also flourishes, occurring in almost pure stands and often reaching a height of 65 feet and a diameter of 3 feet. This species is said to be still more abundant in the mountains of Macedonia.

Above *Pinus peuce* is scrub pine, at about 5,900 feet above sea level. Scotch pine is found at altitudes of 3,900 to 5,500 feet, mixed with *Pinus peuce* in the Rilo mountains and in thrifty unmixed stands in the Rhodope mountains along the Turkish border. The forests in the latter region, however, have suffered greatly from fire. Spruce and fir grow at lower altitudes than pine, and both species thrive in the Rilo mountains, reaching 130 feet and more in height. Yew (*Taxus baccata*) is also present in the spruce and fir region of the Rilo. The coniferous forests of Bulgaria are situated largely in almost inaccessible regions, 25 miles or more from the existing transportation lines, rivers, railways, and passable roads. Hence it has hitherto been impossible to utilize them to any great extent for industrial purposes.

Character of Ownership.—Ownership of the forests of Bulgaria is in a very chaotic state. About one-third of the area designated as state forest land is really in the hands of private individuals for use as grazing land and for agriculture, while the timber standing on such land is claimed by the government. This arrangement goes back several centuries to the time when the Turkish government gave over the waste lands to nomadic tribes for grazing. Sixty years ago these lands were given away to private individuals, but the present Bulgarian government does not recognize this act. In 1904 a forest law was enacted which was supposed to eliminate the confusion on this point, chiefly through the activity of special commissions, which have succeeded in making it possible to abolish the old tenure system, but the effective operation of this salutary measure has been checked on all sides by the opposition of political interests.

The distribution of the forests by ownership is as follows:[1]

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[1] Figures for 1922 show that the state owns 23.98 per cent, municipalities 56.9 per cent, private holders 18.06 per cent, and churches, monasteries and schools 1.06 per cent. Under the provision of the new law the proportion in private ownership will probably be considerably larger.

	Acres	*Per cent*
State	2,230,950	29.7
Communes	3,867,871	51.5
Private	1,284,075	17.1
Churches, convents, and other institutions	132,522	1.7
Total	7,515,418	100.0

The largest areas of state forests are found in the mountainous districts of Provadia, Burgas, Varna, and Peschtera (Rhodope and Rilo ranges), and the smallest in the Danube district, where scarcely 1 per cent of the forests is owned by the state. The government owns 438 separate forests, which lie in the mountains in the north and west of the country.

Communal forests predominate in the southern and western part of the country, and comprise 2,966 separate forests.

Most of the forests of the northwest are privately owned. The private forests are in much smaller areas than the communal and state forests, being distributed in small parcels among a large number of peasants. The famous monastery of Rila owns about 30,000 acres of forest, part of which is very fine timber.

According to altitude, the forests are distributed by ownership as shown in Table 48.

Table 48.—Distribution of Bulgarian Forests (by Altitude)

Ownership	Altitude—Feet			
	1,300	1,300 to 3,280	3,280 to 6,560	Total
	area—acres	*area—acres*	*area—acres*	*area—acres*
State	732,000	858,000	639,000	2,229,000
Communities	1,955,000	1,153,000	759,000	3,867,000
Private	776,000	443,000	197,000	1,416,000
Total	3,463,000	2,454,000	1,595,000	7,512,000[1]
Per cent	46.1	32.7	21.2	

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[1] This differs slightly from the total forest area, due undoubtedly to a different basis of classification.

Annual Growth.—No figures of growth are available. Considering, however, that a large number of the forests are in high mountains where the timber is mature and therefore does not increase in growth; that large areas of forests are greatly overgrazed; that forest fires are prevalent and disastrous; that regulations for the protection of the forests against fire, grazing, and overcutting are either nonexistent or not enforced; and that a large part of the 7½ million acres classed as forest land is nonproductive, the annual growth is not likely to exceed 12 to 15 cubic feet per acre. For the entire area, therefore, the annual growth is probably not over 100 to 112 million cubic feet per year.

Annual Cut.—The cut for 1911, the last year for which official statistics are available, is given as 18,576,000 cubic feet of building timber, 47,871,000 cubic feet of fuelwood, and 1,745,000 cubic feet of charcoal wood, or a total of 68,192,000 cubic feet. The average cut per acre is thus about 9 cubic feet.

Imports and Exports.—The forests of Bulgaria are in a sadly disorganized and neglected state, the accessible parts having been heavily overcut, while those in the remoter mountain regions are still almost untouched. There is no actual commerce in timber except in the Rhodope mountains, where the forests not only supply the local demand but furnish some wood for shipment to Turkey. In other parts of the country the entire cut is consumed at home. Since the lack of proper administration makes it impossible to supply the home demand from the domestic forests, wood is imported from Rumania, Jugo-slavia, Austria, and Turkey. Russia has only recently begun to have a share in exports of wood to Bulgaria. Wood is transported almost exclusively on the Danube river, and consists mainly of softwood—round, squared and sawn. The round timber is worked up in Bulgarian sawmills on the Danube. The only mills are simple water sawmills, and the hauling is done by animals.

According to official statistics for 1911, the kinds of wood products imported into Bulgaria during that year are given in Table 49.

The excess of imports over exports is thus 79,518 tons, or an equivalent of 6,004,000 cubic feet. The imports are constantly increasing, while the exports are steadily decreasing, as may be seen from Table 50.

The main item of import is coniferous construction timber. Among the countries which supplied most of the timber was Austria-Hungary, which furnished about 80 per cent. Next came Rumania with 10 per cent; Turkey and Serbia with 8 per cent; and other countries with 2 per cent. Of the exports, 85 per cent went to Turkey, 3 per cent to Serbia, 1 per cent to Rumania, and 0.7 of one per cent to Austria-Hungary. The remaining 10 per cent was distributed between Germany, France, Greece, Belgium, Egypt and other countries.

Consumption.—With a cut of about 68 million cubic feet and an excess of imports over exports of 6,000,000 cubic feet, the total wood consumption of Bulgaria may be taken as 74,000,000 cubic feet, or 13.5 cubic feet per capita. The consumption of sawlog material amounts to 26,081,000 cubic feet, or 4.7 cubic feet per capita.

Losses Through Fire, etc.—In view of the shortage of supervising personnel and the lack of organization, it is a matter of course that the forests of Bulgaria should fall a prey to destructive agencies of all kinds. The mountain forests are in great danger from fire, storms, and insects. Fires as severe as those which occur in the Rhodope mountains in Bulgaria are unknown elsewhere in Europe except possibly in the virgin forests of northeastern Russia. At least one-fourth of the state forest of that section, the total area of which is 250,000 acres, has been ruined by fire. Most of the fires are supposed to originate across the border in Macedonia, where they are started by the Turks to drive revolutionists out of their hiding places. Camp fires of these outlaw bands also cause forest fires, which rage for weeks at a time during the dry season and spread over the Bulgarian borders. Many fires are started maliciously. It is almost impossible to fight forest fires in the sparsely settled mountain districts.

In the coniferous forests of the Rilo and Rhodope mountains much

TABLE 49.—BULGARIAN IMPORTS OF WOOD PRODUCTS

Kinds of wood	Metric tons
European hardwoods (oak) for construction purposes, rough	2,182
European softwoods (spruce, pine, etc.), rough	45,434
European hardwoods, sawn	1,128
European softwoods, sawn	40,501
Railway ties, oak (from Serbia and Turkey)	2,732
Railway ties, pine (chiefly from Turkey)	955
Total	92,932
Fuelwood	2,379
Charcoal	108

The exports during the same year were as follows:

Kinds of wood	Metric tons
Fuelwood	10,506
Charcoal	3,897
Hardwoods	17
Softwoods	1,481
Total	15,901

TABLE 50.—BULGARIAN TIMBER EXPORTS AND IMPORTS

Year	Hardwood				Softwood				Wood for fuel		Charcoal	
	Imports		Exports		Imports		Exports		Imports	Exports	Imports	Exports
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Tons	Tons	Tons
1900........	925	$12,307	1,405	$20,386	17,447	$152,692	13,876	$156,539	11,100	10,627	18	2,048
1905........	3,927	63,461	120	1,346	62,992	703,846	8,792	100,386	16,364	6,840	765	487
1910........	5,441	77,539	81	1,150	79,514	918,269	6,707	116,152	6,999	5,092	377	2,354
1911........	6,042	86,539	17	384	86,890	1,235,192	1,481	33,269	2,379	10,506	108	3,897

damage is caused by violent storms, and trees broken by the wind or slightly injured by fire afford breeding places for noxious insects, which also do great damage.

Another prolific source of deterioration of the forests of Bulgaria is theft by the inhabitants, who regard the right to cut timber when and where they choose as inalienable, and resent any attempt to restrict a practice which necessarily results in enormous waste.

A further source of destruction is the unrestricted grazing of animals in the forests. Owing to climatic conditions, grass grows on the natural pasture lands only for a short period during the year, hence animals are grazed almost entirely in the broadleaf forests. Stall feeding, artificial pasturage, and cultivation of forage plants are almost unknown. Since grazing forms a highly important phase of economic life in Bulgaria, it cannot be dispensed with. The problem is rather to find feeding grounds for the vast herds of sheep, goats, and cattle outside the forests. In the high mountain regions, mountain pasturage is the solution. In the lower regions it will be necessary to introduce artificial pasturage and the cultivation of forage plants. The Government distributes annually 55,115 pounds of clover seed free of charge for this purpose.

Forest Management.—There is no systematic attempt to regulate cutting and reproduction in the forests of Bulgaria. The efforts of the very inadequate personnel are limited to endeavoring to satisfy the wood demand with dry wood, which is all too plentiful as a result of windstorms, insect damage, and fires. Natural regeneration, for which conditions in all other respects are exceptionally favorable, is practically out of the question on account of unrestricted grazing. The Genisch-Ada State forest is a good example of successful regeneration where grazing is eliminated. The forest lands nearest the Kamtschia river were at one time practically without trees, but they now contain thrifty growths of polewood which only need proper thinning in order to develop into fine timber.

Some artificial planting has been done with Scotch pine near Sofia.

Very little surveying and map-making has been done in the forests owing to lack of money and to the uncertainty of the boundaries.

Forest Laws.—When Bulgaria was separated from Turkey, the dense forests that formerly covered the country had nearly disappeared and no steps had been taken to conserve them. In December, 1878, soon after the establishment of the Principality of Bulgaria, one of the reforms instituted by the new Government was the issuance of conservation regulations and the appointment of overseers and keepers charged with the duty of protecting the forests. Other regulations followed, prohibiting the export of wood, declaring all forest lands taxable, and providing for reforestation. Still later the sections to be felled were prescribed, monopolies and destructive exploitation were forbidden, and instructions published as to the best methods of preventing and combating forest fires.

In 1884, the Bulgarian National Assembly enacted the first law for the protection of the forests. It provided for the division of the country's forests into classes, i.e., state, parish, and private, general control being placed in the hands of the Minister of Finance, and also made provision for the appointment of inspectors, foresters, and keepers who were charged to preserve the woods from injury and to divide them into districts, so that felling and thinning could be done rationally and in such manner as to provide sufficient wood for building, fuel, and charcoal.

Another law was passed in 1889, which, among other things, contained provisions for much-needed reforestation. Nurseries were established which in a short time had millions of young trees ready for planting, and special courses of study were arranged for foresters and keepers to equip them better for the work of conservation. Further forest legislation was enacted in 1904.

Bulgaria has thus a number of excellent forest laws, based on the results of practical forestry in Western Europe. But unfortunately the executive power to enforce the laws is lacking, owing to the vicissitudes of party government, which also operate to deprive the forest administration of means and personnel to carry on its work. Forest officials who attempt to enforce the laws are often intimidated into submission by the politicians or removed from office.

The status of ownership of the communal and private forests, as has already been stated, is inaccurately defined in many cases, and this often leads to tedious, expensive litigation. The law under Turkish rule specified that communal forests could be neither sold nor leased, in order that a supply of wood might be assured to the inhabitants. This provision has since been generally disregarded, however, and the communes, centuries later, are now demanding the restoration of their forests.

Prior to the law of 1922, the forest administration was entrusted to a department of the Ministry of Agriculture and Commerce, and was under a chief and three permanent assistants. The forests were divided into three districts with an inspector at the head of each. There were 40 forest supervisors and 23 assistants who were directly associated with the administration, and 30 supervisors in the remote communal forests. Protection and policing of the state forests were in the hands of 500 state guards, while about 2,000 rangers were employed in the communal forests. The average territory of one supervisor was 172,900 acres, and the number of forest rangers was also inadequate. For instance, in the district of Bosilograd there were only 3 guards for a territory of about 3,000,000 acres.

It is not humanly possible for the personnel even to cover the territory assigned to them, much less carry out silvicultural projects. Proper protection of the forests is further hindered by extremely low fines for misdemeanors, and by the formalities involved in prosecuting offenders. The forest guards are also so poorly paid that they are usually open to bribes, and are therefore not in a position to combat abuses.

The personnel is also very poorly prepared. The one school for lower forest officials, formerly located at Tscham-Karja in the Rilo mountains, had to be discontinued in 1893 for lack of sufficient appropriation, which was refused by the Government.

In May, 1922, a new forest law was enacted which evidently aims to do away with the laxities of the enforcement of the previous laws and provides for a more thorough organization of the Forest Service. One of the provisions of the law is that no private owner may possess more than 50 acres of forest land in the plains and 125 acres in the mountains. In order to secure a more equitable distribution of forest land the municipalities under this law are to allot from 5 to 25 acres of forest to each family residing within their limits from the municipally-owned forest lands. The law specifically prohibits pasturing in young forests. In case of fire all residents of nearby localities are bound to help to extinguish it under penalty of fine. The administration of all Bulgarian forest lands comes under the supervision of the Department of Agriculture. The country is divided into six administrative units with a chief supervisor at the head of each unit and these in turn are sub-divided into smaller divisions. A special committee appointed by the Department of Agriculture is to determine the area of forests and the kind of trees to be grown, as well as what lands shall be expropriated and used only as forest lands after compensation of the owners. The law provides that mountain pasture lands, pastures within forests, steep mountain slopes, areas subject to floods, river banks, and areas subject to erosion, are forest lands. Cutting in all forests and reforestation on both private and state lands is done under the supervision of the Forest Service. Evidently there is no great difference between the legislative status of private and public forest lands. The state undertakes to further the forestry interests of the private owners on the same basis as its own. It remains to be seen how effective this new law will prove in repairing the forest devastation of the past.

Probable Future.—The present deficiency in timber in Bulgaria is due not to the lack of forest resources but to their inadequate development. Until the mountain forests are made accessible for exploitation, Bulgaria will depend upon timber imports. The chief providers of Bulgaria are largely its nearest neighbors, Jugo-slavia and Rumania, which have a large amount of wood available for export.

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CZECHOSLOVAKIA

Forest Area.—The new Republic of Czechoslovakia is made up of territory formerly belonging to Austria-Hungary, and includes approximately the former Austrian crown lands of Bohemia, Moravia, and Silesia, and Slovakia and Sub-Carpathian Russia, which formerly comprised the Hungarian region north of the Danube to the Carpathians at Kaschau. The population of these territories is 14,000,000, and the total land area slightly more than 36 million acres.

Czechoslovakia has an enormous forest wealth, ranking as one of the most heavily wooded countries of Europe. According to Dr. Karel Siman, about 12,500,000 acres are under forest, or 0.88 acre for every inhabitant. This is 34.3 per cent of the total area of the country. This is distributed by provinces as follows:

	Acres	*Per cent under forest*
Bohemia	3,800,000	29.6
Moravia	1,540,000	28.1
Silesia	442,000	36.0
Slovakia	4,942,000	34.5
Sub-Carpathian Russia or Rusinia	1,630,000	
Total	12,354,000	

This is nearly four times the forest area of England, over one-half that of France, and more than the pre-war forest area of Italy.

Character of the Forest.—Coniferous forests predominate in Bohemia, Moravia, and Silesia. Pines, spruce, and fir cover 78 per cent of the forest area, broadleaf species 9 per cent, and mixed stands about 13 per cent. Broadleaf forests (beech and oak) prevail in Slovakia and Sub-Carpathian Russia, forming 67 per cent of the whole, while coniferous species constitute 33 per cent.

Character of Ownership.—The forests are distributed by ownership as follows:

	Acres	*Per cent*
State	1,398,000	11.3
Local bodies, limited companies, and charitable institutions	2,467,000	20.0
Church	592,000	4.8
Private	7,897,000	63.9
Total	12,354,000	100.0

The greater part of the privately owned forest is on large landed estates.

Annual Growth, Cut, and Consumption.—The annual growth of the forests of the country is estimated at approximately 564,800,000 cubic feet, or 45 per acre. Of this, 353,000,000 cubic feet is timber and 211,800,000 firewood.

Nearly half of the growth is conifers and the remainder hardwoods, especially beech and oak. Since the forests of Czechoslovakia are managed in such a way that only the annual growth is utilized, the normal annual cut may be estimated to equal the annual growth, namely, 564,800,000 cubic feet.

Although no figures are available to show what the present consumption is or may become, it is evident that Czechoslovakia produces more wood than it needs for its own use. It is estimated that exports of sawn lumber, not including finished articles, for 1920 were about 106 million cubic feet. Since the export trade is regulated by a special wood commission which determines the percentage of wood that may be exported, if the forests were utilized to their fullest extent 458,900,000 cubic feet would be left for domestic use, or nearly 33 cubic feet per capita.

Exports and Imports.—Czechoslovakia produces more wood than it consumes, hence it is a wood exporting country. The geographical location of the country and its navigable rivers favor exportation, as does the fact that several neighboring countries (especially Germany and Hungary) are suffering a shortage of timber production. Since rail transportation facilities are at present rather poor, it is impossible to export the entire available quantity of merchandise. Before the war much of the timber output of Czechoslovakia was bought by merchants of Saxony, Bavaria, and Vienna. Since the war large quantities have been exported to Italy, France, Germany, Switzerland, and Holland. It is estimated that the export of sawn lumber (not including finished articles) for 1920 was about 105,900,000 cubic feet. It is doubtful whether such an export trade can be maintained for a long time without either depleting the forest or reducing the domestic consumption.

There are two principal trade regions: (1) The provinces of Bohemia, Moravia, and Silesia, served by the Moldavia River, which is floatable, and by the Elbe, which is navigable. About 17,650,000 cubic feet of long timber was exported annually by these routes before the war. Germany takes most of the superfluous output of pulp and mine wood, medium-sized rough timber, and fuelwood. (2) Slovakia includes a particularly well wooded portion of the Carpathians, with extensive stands of beech, Norway spruce, and fir. It is likely that most of the output of these forests will go to Germany and Hungary.

Wood-Using Industries.—Efforts are being made to build up wood-using industries in Czechoslovakia for the purpose of exporting partly or wholly finished merchandise in exchange for raw materials, of which the industry is in great need. The country has 4,420 frame saws, 215 of which are in modern steam and electric mills, and about 30,000 laborers are employed in the industry. Among the chief wood-using industries are factories for the manufacture of furniture, toys, brushes, and musical instruments. There are over 4,000 molding, trimming, sash and door, and other mills, and the bentwood furniture industry, one of the leading industries of the country, uses about 7,060,000 cubic feet of beech. Wicker furniture is also produced in considerable quantities. There are 12 factories engaged in this industry at present. Other industries which consume large quantities of wood are those manufacturing barrels, wagons, matches, pencils, shingles, and agricultural implements. The large forest resources of the country have made possible a high degree of development in the paper industry. There are 29 wood-pulp mills, five independent cellulose factories, 68 paper mills, and 44 cardboard mills, with a total annual output of 80,000 tons of wood pulp, 226,000 tons of paper, and 12,000 tons of cardboard. About 35,300,000 cubic feet of wood is consumed by the paper and pulp mills. Tannin is an important item of forest production. The seed industry is under the direct control of the state, which aims to stimulate production and to regulate the quality and germinating power of the seed.

Management and Forest Laws.—The forests of Czechoslovakia are well managed under a far-sighted policy. No land which has once been used for forest purposes may be used otherwise without official sanction, and cut-over land must be reforested within five years. Systematic forestry is practiced on about three-fourths of the total forest area. No forest may be wilfully destroyed, or cut in such a way as to impair its usefulness. Adequate protection against fire, noxious insects, and trespassing must be maintained by forest owners. Legislation covering these points was enacted before the present Republic came into existence, but the most important provisions have been adopted by the new government. A decree of the Ministerial Council of March, 1920, created the Czechoslovak Wood Commission as an auxiliary government institution for the period of transition from abnormal to normal conditions. The object of the Commission is to "furnish supervision over proper conservation of wood for domestic use and over the export and import of timber." The Commission has the exclusive right to regulate the terms of export and import of timber, and to determine minimum export prices and charges for import and export licenses. Revenues are turned over to the state treasury. The result of such control of wood export and import is to remedy the evil of wasting a very important national resource. In fixing minimum prices the Commission has given preference to finished or partly finished products over logs and round timber. Prices each month depend on domestic consumption, exports, state of the world markets, and rate of exchange. With the object of eliminating profiteering as far as possible, licenses are granted only to established dealers.

Legislation is now pending which will place the chief administration of all forests in the hands of the government. This will result in uniform, systematic organization and exploitation of the forest resources of the country, with corresponding increase of the annual yield.

Probable Future.—Czechoslovakia will play an important part in supplying western Europe with forest products. The part which was once occupied by Austria-Hungary will now be assumed, to a large extent by Czechoslovakia, and to a smaller extent by Jugo-slavia. The well-managed forests of Czechoslovakia hold out a promise that her resources will not be depleted as is likely to happen with the forests of other countries which arose as a result of the breaking up of the Austrian Empire.

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DENMARK

Forest Area and Character of the Forest.—The forest area of Denmark, according to the latest statistics, is about 822,500 acres—8.2 per cent of the total area of the country, or a per capita forest area of 0.27 acre. The islands of Seeland, Bornholm, Laaland, Falster, and Fyen, which occupy 9.3 per cent of the total area of Denmark, contain nearly half of the total forest area. The other half is found on the mainland (Jutland). Only 85 per cent, or about 700,000 acres, may be classed as productive forest land. To this must be added about 49,500 acres in Slesvig, which has been joined to Denmark. The total forest area of Denmark should now be considered as 872,000 acres.

Of the total forest area, 41 per cent is covered by beech, 5 per cent by oak (*Quercus pedunculata*), 5.6 per cent by ash, maple, birch, elm, and alder, and 48.4 per cent by conifers, especially spruce (*Picea excelsa*). Of the conifers, spruce (*Picea excelsa*) and fir (*Abies pectinata*) together with a little Douglas fir (*Pseudotsuga taxifolia*) occupy about 27 per cent, Scotch pine (*Pinus sylvestris*) and larch (*Larix*) 2 per cent, and mountain pine (*Pinus montana*) (in the heaths), 16.5. The remainder is under nurseries and other use. The planting on the Jutland heaths is effected almost exclusively with spruce and mountain pine (*Pinus montana*). Including Slesvig, conifers comprise 49.9 per cent.

Character of Ownership.—Of the total forest area about 24 per cent, or 197,400 acres, belongs to the state; 2 per cent, or 16,400 acres, to communes; 27 per cent, or 222,100 acres, to associations and corporations; and 47 per cent, or 386,600 acres, to private owners. Of the state forests 7 per cent, or about 58,000 acres, is really sand dune forest. Excluding the forests under parks, the forests of the Soro Academy, and young plantations, the productive forest area belonging to the state is only about 90,000 acres.

In Slesvig about 25,000 acres are owned by the state and 25,000 are distributed between municipalities, corporations, and private owners, thus making a total area of 222,000 acres of state-owned forests at present in Denmark.

Annual Growth, Cut, and Consumption.—Unfortunately, there are no figures regarding the cut and growth nor any data concerning wood consumption. Denmark fully appreciates the value of forests, treats most carefully those few which she possesses, and tries to increase the area as much as possible by planting waste lands. The area of forests, however, is very small and the production far too little for a population of 3 million inhabitants. The total productive forest area is probably not over 700,000 acres.

The growth in the forests of Denmark must be about the same as that in Belgium and the Netherlands—about 50 to 60 cubic feet per acre. The annual cut per acre is probably less, say 40 cubic feet for the total forest area, and about 50 cubic feet for the productive forest area.

A large part of the forests of Denmark is still in the form of young plantations. The annual cut per acre in the state forest is in the neighborhood of 35 cubic feet per acre. It is probably greater on private lands. The total annual production of wood in Denmark, therefore, must be about 35,500,000 cubic feet. The excess of imports over exports amounts on an average to 35 million cubic feet of timber. This would indicate a total consumption of timber of about 70 million cubic feet, or 24 cubic feet per inhabitant. Of this probably two-thirds is sawlog material. Against an annual cut of about 35 million cubic feet there may be placed an annual growth of at least 40 million cubic feet, or an excess of growth over cut of 5 million cubic feet a year.

Imports.—According to the report of the Danish Statistical Bureau, the imports of wood in 1912 and 1913 were as shown in Table 51.

TABLE 51.—IMPORTS OF WOOD TO DENMARK

Kind of product	1913	1912
	cu. ft.	*cu. ft.*
Round timber	314,523	349,788
Sleepers	1,313,654	1,473,704
Hewn	5,266,089	3,965,743
Sawn	25,217,508	22,594,965
Firewood	1,662,701	1,379,842
Planed	2,739,598	2,373,466
Total	36,514,073	32,137,508
Oak, sawn	314,452	319,677
Mahogany, round or hewn	84,155	85,391

Forest Management.—The average annual cut in the state forests is about 7,589,500 cubic feet, or 84 cubic feet per acre of productive forest land. Scotch pine (*Pinus sylvestris*) is grown only to a limited extent, and is cut generally in the 75th to 90th years. Mountain pine (*Pinus montana*) is cut at an age of 40 to 45 years; spruce at 60 to 75 years; silver fir (*Abies pectinata*) at 75 to 80 years. The state never sells standing timber; trees are felled by the state itself.

The total annual expenditure for the period 1906-1909 was $322,000, or $1.63 per acre. The total annual gross revenue for the same period was $460,448, or $2.33 per acre. The comparatively small net revenue is due largely to the fact that a considerable amount is spent on young plantations in the heath belonging to the state and the areas thus planted will give no profit for a long series of years. The state plants about 1,500 acres annually. Beech forests are managed under a gradual cutting system, and spruce and oak by clear cutting in small areas. Forest fires are rare, and occur almost exclusively in the heath plantations of Jutland. The Danish Forest Service is a branch of the Department of Agriculture and has two principal divisions: one is charged with the administration of state forests and the dunes, and the other oversees the privately owned forest lands. Headquarters are in Copenhagen, but there are various districts covering the country.

Education.—A course in forestry is given at the Danish College of Veterinary Medicine and Agriculture. In addition, there is a forest experiment station near Copenhagen. A popular forestry association (Dansk Skovforenings), established in 1888, issues a quarterly magazine, "Tidsskrift," which is also the organ of the association of the technically trained foresters. The Danish Heath Society is a private association, formed in 1866, for the purpose of reclaiming and making productive the extensive heath areas of Jutland. The Heath Society is managed by a board of 35 directors, who elect an executive committee of three, with a technical deputy. As a result of the activity of this society, the unproductive land in Denmark, which in 1866 amounted to 2,192,000 acres, by 1920 was only 944,640 acres, a reduction of considerably over one-half.

Forest Laws.—*The Forest Law of 1805.*—This law provided that no one who purchased forest land could cut it during a period of ten years except with the approval of the state forester, who was to mark the timber to be removed. It also provided for the exclusion of all grazing animals from the forest and the classification of lands for determining what areas should be kept permanently in forest as distinct from agricultural land. Although there is a likelihood that the Danish law of 1805 will soon be revised, the essential provisions of the law will undoubtedly be continued. There are also railroad fire laws, enacted in 1920, which provide for the payment of damages by the railways for fires set from sparks from the locomotives. These laws also provide for fire lines to be constructed parallel to the right of way on privately owned timberlands.

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ESTHONIA

Forest Area.—The newly created State of Esthonia occupies an area of 14,823,000 acres and has a population of 1,750,000. It includes the old province of Esthonia and about one-half of the province of Livonia. The forests of Esthonia are in the neighborhood of 2 million acres, or 13.3 per cent of the land area. The per capita forest area is 1.1 acre. By provinces the forest area is distributed as follows:

Esthonia	856,500
Livonia	1,108,450 (estimated)
Total	1,964,950

Character of the Forest.—Esthonia lies in the region of temperate hardwoods and conifers. Scotch pine and spruce predominate, however, the proportion of each being about the same. Conifers probably form 65 per cent and hardwoods 35 per cent of the total.

Character of Ownership.—The forests are mostly in private ownership, particularly in the former province of Esthonia, where state forests occupy only 5,300 acres, the rest being private forests. There are no peasant forests. No figures are available as to the proportion of state forests in the part of Livonia now included in the State of Esthonia, except that they form not over 15 per cent of all the forests.

Esthonia is chiefly important not so much because of production of lumber as on account of the trade in lumber. Most of the lumber shipped from various points in Russia used to go through Riga, which was the largest lumber port in Russia, and one of the largest in the world. The industry is centered near Riga and its suburbs, where thousands of men are engaged in the delivery, reshaping, and shipping of lumber. Furniture making and the manufacture of cork are also developed, especially the latter. Within the last 12 years before the war the sawmills nearly doubled in capacity. The lumber industry of Esthonia in the future will also largely depend on raw materials from Russia, as the country itself has not a large enough area to maintain an important lumber industry.

Cut, Growth, and Consumption.—There are no statistics as yet for the cut, growth, or domestic consumption of the newly established state. The figures given for European Russia include Esthonia. The growth figures given for European Russia probably apply also to Esthonia, but the cut and consumption must be much larger than the average figures for European Russia. Even before the war the cut exceeded the growth, and as Esthonia was a more highly industrialized region than the rest of Russia, the consumption of timber must have been much larger, probably in the neighborhood of 70 cubic feet per capita.

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See references for Russia.

FINLAND

Finland is situated approximately between 60° and 70° north latitude and between 21° and 33° east longitude (Greenwich). For nearly half of its entire boundary Finland is surrounded on the south and west by the waters of the Gulf of Finland, the Baltic Sea, and the Gulf of Bothnia. On the north it borders upon Sweden and Norway, nearly reaching the shores of the Arctic Ocean, and on the east upon the original Russian provinces of Archangel and Vologda. For a short distance on its southern boundary, between Lake Ladoga and the Gulf of Finland, it comes in contact with the Province of Petrograd. As compared with the northeastern provinces of Russia, Finland is slightly smaller than the Province of Vologda; as compared with western European states, Finland could easily accommodate Great Britain, Belgium, and Holland.

Although Finland is called the country of swamps, Suomi (suo-swamp and mi—land), it could, with equal propriety, be called the country of forests and lakes. The latter occupy a vast area amounting to nearly 12 per cent. The only statistics on the forests of Finland which may be regarded as reliable are those on the state forests. Even these figures are subject to variation from year to year as forest surveys proceed and the exact areas are more accurately determined. Only approximate estimates of forest lands and their ownership are available.

The acreage under agricultural crops and under forest by provinces, is shown in Table 52.

Agricultural land forms only 8.5 per cent of the entire land area of Finland, while 91.5 per cent is under forests, swamps, and peat bogs. Although in Finland, especially in the northern part, there are many areas covered with tundra which can scarcely be made into agricultural land, the area under agriculture is growing and it is bound to increase still further with the growth of population, which has increased three and one-half times within the last 100 years. Clearing of the forest for agricultural purposes takes place especially in the southern half of

Finland, where privately owned forests predominate. In the absence of a rigid forest protection law the clearing of land goes on without hindrance. Even in the state-owned forests some lands are being turned over for agriculture, though with considerable caution.

Forest Area.—The forest area is about 49,410,000 acres, or in the neighborhood of 60 per cent of the entire land area. The productive forest area, however, is only about 37,500,000 acres and its distribution, by provinces, is shown in Table 53.

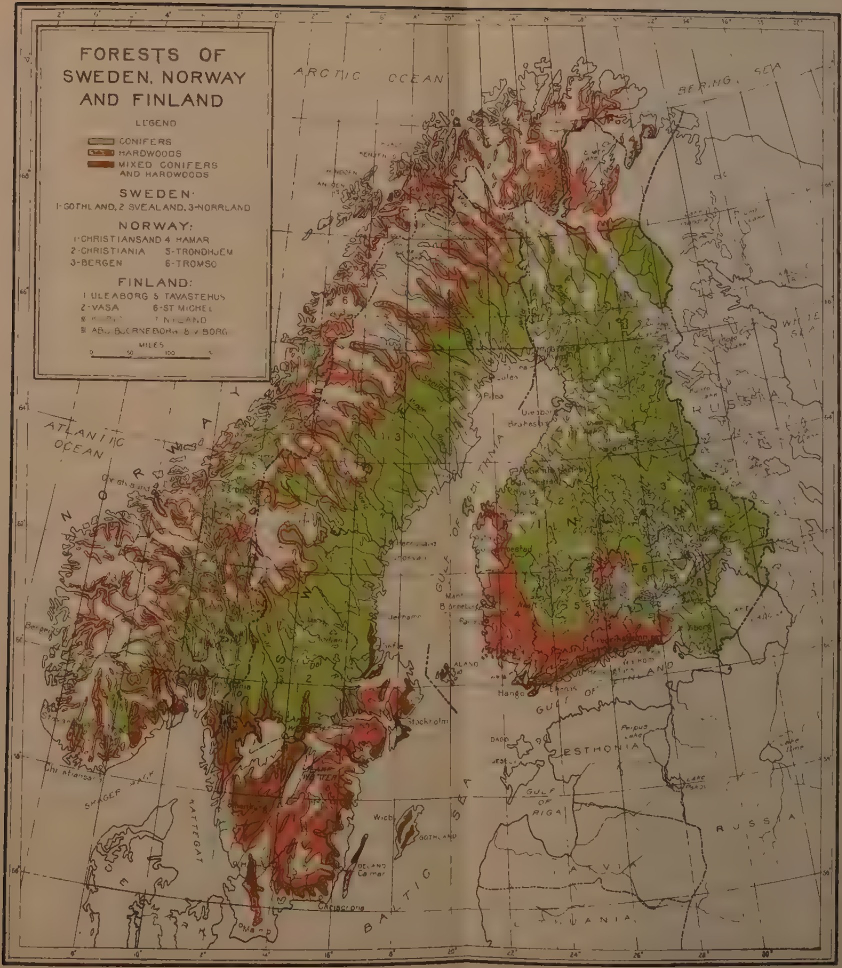
The actual productive forest area of Finland is thus 45.6 per cent of the total land area and 11.2 acres per head of population.

Character of Ownership.—The ownership of forests is shown in Table 54.

Private forests form about 65 per cent of the entire forest area. They are found in large bodies in all the provinces except Uleaborg, where the state forests form 70.5 per cent and private forests 29.5 per cent. On the whole, state forests form only about 35 per cent of all the forests. Of special importance are the private forests belonging to the pulp and paper companies. There are several companies which hold from 700,000 to 1,000,000 acres of forest lands each. The acquisition of such large areas by the pulp and paper companies was prompted by their desire to insure for their operations a supply of raw material. This is especially true of southern Finland, where deforestation has proceeded farthest and where the large companies have difficulty in securing raw material. The land was bought chiefly from peasants and other individual owners who not long before had been selling such land at a very low price.

TABLE 52.—ACREAGE IN CROPS AND FOREST IN FINLAND

Province	Total land area	Area under agriculture	Area under other use, chiefly forest lands	Agricultural land	Other land
	acres	*acres*	*acres*	*per cent*	*per cent*
Nyland	2,784,748	652,339	2,132,409	23.4	76.6
Abo and Bjorneborg	5,737,983	1,151,083	4,586,900	20.1	79.9
Tavastehus	4,312,754	730,434	3,582,320	16.9	83.1
Viborg	7,751,441	802,678	6,948,763	10.4	89.6
St. Michel	4,110,416	490,234	3,620,182	11.9	88.1
Kuopio	8,940,988	762,494	8,178,494	8.5	91.5
Wasa	9,494,377	1,269,302	8,225,075	13.4	86.6
Uleaborg	39,169,529	1,170,482	37,999,047	3.0	97.0
Total	82,302,236	7,029,046	75,273,190	8.5	91.5


FORESTS OF SWEDEN, NORWAY AND FINLAND
LEGEND
CONIFERS
HARDWOODS
MIXED CONIFERS AND HARDWOODS
SWEDEN:
1-GOTHLAND, 2 SVEALAND, 3-NORRLAND
NORWAY:
1-CHRISTIANSAND 4 HAMAR
2-CHRISTIANIA 5-TRONDHJEM
3-BERGEN 6-TROMSO
FINLAND:
1 ULEABORG 5 TAVASTEHUS
2-VASA 6-ST MICHEL
3 KUOPIO 7 NYLAND
4 ABO BJORNEBORG 8 VIBORG
MILES
0 50 100 150
ARCTIC OCEAN
BERING SEA
WHITE SEA
ATLANTIC OCEAN
NORWAY
SWEDEN
FINLAND
RUSSIA
GULF OF BOTHNIA
GULF OF FINLAND
GULF OF RIGA
BALTIC SEA
SKAGER RAK
KATTEGAT
DENMARK
ESTHONIA
LATVIA
LITHUANIA
Luleå
Piteå
Uleaborg
Brahestad
Hernösand
Gefle
Stockholm
Hango
Viborg
Bergen
Christiansand
Wisby
GOTHLAND
OELAND
Calmar
Carlscrona
Malmö
WETTER
ALAND
DAGO
Peipus Lake
Lake Ilmen
Lake Ladoga

Another kind of forest which is classed with private ownership is the forest belonging to the government but leased to private individuals for exploitation for certain periods of time. The revenues from such leases are used for paying the salaries of military and civil personnel. Although lately a law has been passed prohibiting the leasing of any more forest lands, this law confirmed the rights of the original lessee to the forests which had been leased prior to its enactment. Such forests are leased for twenty years on very liberal terms, and the right of lease is transferred by inheritance in the family of the lessee. For violation of the

TABLE 53.—DISTRIBUTION OF PRODUCTIVE FOREST IN FINLAND

Province	Productive forest area	Per cent of total land area
	acres	
Nyland	1,594,936	57.3
Abo and Bjorneborg	2,789,651	48.6
Tavastehus	2,557,356	59.3
Viborg	4,215,923	54.4
St. Michel	2,208,627	53.7
Kuopio	4,195,403	46.9
Wasa	3,864,688	40.7
Uleaborg	16,096,514	41.1
Total	37,523,098	45.6

TABLE 54.—OWNERSHIP OF FINNISH FORESTS

Province	Area of productive forest land			Per cent of state forests
	State forests	Private forests	Total	
	acres	*acres*	*acres*	
Nyland	5,378	1,589,558	1,594,936	0.3
Abo and Bjorneborg	161,039	2,628,612	2,789,651	5.8
Tavastehus	146,386	2,410,970	2,557,356	5.7
Viborg	324,421	3,891,502	4,215,923	7.7
St. Michel	67,117	2,141,510	2,208,627	3.0
Kuopio	617,314	3,578,089	4,195,403	14.7
Wasa	506,914	3,357,774	3,864,688	13.1
Uleaborg	11,341,717	4,754,797	16,096,514	70.5
Total	13,170,286	24,352,812	37,523,098	35.1

regulations or mismanagement of the leased forest properties the lessee may be deprived of his rights and the property transferred back into full ownership of the state. The total area of such leased land in 1910, the revenue from which was used for military purposes, was 662,923 acres, of which the actual productive forest land was 225,701 acres. The leased lands, the revenue from which was used for the support of civil departments, amounted to 62,929 acres. Of this the productive forest land was 19,667 acres.

The churches own a considerable area, about 523,800 acres, of which 289,864 acres is good productive forest land. Municipalities in Finland do not own large areas of forests. In 1910 the municipal forests amounted to 98,820 acres. Rural communities own about 197,640 acres.

Character of the Forest.—The forests of Finland extend to the 69th degree of northern latitude and are composed almost exclusively of pine, spruce, and birch, with a smaller amount of alder. Only a few species, like birch, extend farther north than 69 degrees. The most valuable species is pine, but the pine forests are being greatly reduced by fires and cutting. It is no exaggeration to state that there are no forests in Finland which have not been burned at some time or other. During some years forest fires have attained enormous proportions. Thus in 1868 about 160,650 acres of forests were devastated, in 1883 135,810 acres, and in 1896 167,940 acres. The forest fires kill out pine and especially spruce, which is even more susceptible to fire than pine. Over vast burned-over areas in Finnish Lapland and in general in the northern part of the country birch has taken possession of the ground and crowded out the coniferous species, pine suffering particularly. Spruce coming up under birch has attained predominance over pine, particularly on the more humid or swampy soils. Spruce, after it reaches a certain size, shades the ground to such an extent that reproduction of other species is impossible, and pine is thus entirely eliminated. Another factor which has contributed to a change in the composition is the once widely used method of agricultural practice. This practice consisted of clearing and burning parcels of forest and utilizing the clearing for agriculture. After the clearing had been used for one or two years for cropping it was abandoned. Such abandoned fields, like the burned areas, became densely covered, especially on humid soils, with birch which entirely eliminated the pine. When the birch reached 25 to 35 years it was cut down and burned again and the ground used for a short time for agriculture, after which it was again abandoned. It is characteristic that after the second abandonment the areas become covered not with birch but with a still less desirable species, namely white alder. This is the method by which enormous areas of white alder have come into existence in many parts of Finland. Another reason for the gradual reduction in the area of pine is the damage done to pine forests by the grazing of reindeer. In searching for moss the reindeer migrate from one place to another and in their migration destroy the pine over large areas. In the far north pine trees are damaged even in the 60th or 70th years because of their small size. On the whole, pine does not grow to large dimensions in Finland, probably because of the shallow soil. Most of the trees, therefore, are short-boled, especially in the north. In central and southern Finland, however, a full stand 150 to 200 years old on good forest soil may contain as much as 9,528 cubic feet per acre. The growth of pine is very slow and the rotation adopted for it is fairly high, approximately as follows:

Kind of timber	Southern Finland	Central Finland	Northern Finland
	years	*years*	*years*
For small timber and firewood	70–110	80–120	120–180
For large sawlog timber	110–160	140–200	180–230

These rotations are not followed very strictly, however, and the tendency at present is to lower rotations. This has been brought about by the large demand on the international market for smaller sizes. Since the Finnish forests are exploited chiefly for export trade, forest management is adapted to the demands of the market and the rotations lowered.

The species next in importance to pine is spruce (*Picea excelsa* and *Picea obovata*), which forms pure stands as well as mixtures with other species. It occurs chiefly on swampy and moist soil. Because of forest fires and cutting, the area under spruce is increasing at the expense of pine. Not long ago when the price of spruce lumber on the foreign market was lower than that for pine, such a change in the composition from a more valuable species to a less valuable one was very undesirable, but within the last 10 or 15 years the market has changed. The prices for spruce lumber are now almost equal to those for pine. In addition, a demand has grown up for spruce pulp wood. Since pulp wood need not be very large in size, it is possible to grow it on shorter rotations. For this reason the foresters in Finland have come to the conclusion that the process of crowding out pine by spruce should not be interfered with, since this process, from an economic standpoint, meets the needs of the market. The rotations adopted for spruce are approximately these:

Kind of timber	Southern Finland	Central Finland	Norther Finland
	years	*years*	*years*
For small timber and firewood.......	80–110	90–120	100–160
For large sawlog timber............	110–140	120–160	160–220

Other conifers which occur naturally in Finland are juniper (*Juniperus communis*) and yew (*Taxus baccata*). Larch is found only in artificial plantations.

Of the hardwoods, the most widely distributed species is birch (*Betula verrucosa* and *B. odorata*), which occurs over vast areas on burns in northern Finland and enters also into the composition of forest stands in all other parts of the country. Birch predominates especially in forests where the more valuable coniferous species have been culled out. Black alder (*Alnus glutinosa*) forms pure stands along the sea coast and lakes, especially in the southeastern part of Finland. White alder (*Alnus incana*) was originally distributed in small quantities in the form of narrow strips along the shores of rivers. As a result of a system of clear cutting with temporary agricultural use, however, this species has now taken possession of large areas, particularly in northern Finland. Aspen (*Populus tremula*) occurs as an admixture with conifers. It reaches fairly large dimensions, however, only on moist soils. "Popple" (aspen), like white alder, represents a weed in the Finnish forests and only in limited localities furnishes a fairly good material for the match and pulp industries. There are some other species, but they grow very scatteringly and are of more interest botanically than economically. Among these are basswood (*Tilia ulmifolia*), oak (*Quercus pedunculata*), maple (*Acer platanoides*), ash (*Fraxinus excelsior*), elm (*Ulmus effusa* and *U. montana*), mountain ash (*Sorbus aucuparia*), wild apple, wild cherry, and a number of willows (*Salix caprea, S. pentandra, S. phylicifolia, S. glauca, S. lanata, S. hastata, S. lapponum, S. vagans,* and several others).

Amount of Standing Timber.—The total amount of standing timber in the state forests is estimated at 13,003,000,000 cubic feet. This is distributed in the different districts about as shown in Table 55.

The average stand per acre of productive state forest land is in the neighborhood of 1,000 cubic feet. Assuming the same stand for all other forest lands the total stand of merchantable timber in Finland must be in the neighborhood of 37,000,000,000 cubic feet.

Annual Growth.—The total annual increment is estimated at 1,242,000,000 cubic feet, or about 33.0 cubic feet per acre of productive

TABLE 55.—DISTRIBUTION OF STANDING TIMBER IN STATE FORESTS—FINLAND

District	Cu. ft.	District	Cu. ft.
Lappmarken district	2,420,000,000	Abo-Tavastehus district	382,000,000
Kemi district	2,983,000,000	Domarnas, Siikakangas, Evois-Vesijako, and Jorois districts	79,000,000
Ijo district	2,068,000,000	Total	13,003,000,000
Uleatrask district	1,577,000,000		
Osterbotten district	889,000,000		
Central Finland district	529,000,000		
Kuopio district	1,289,000,000		
Viborg-St. Michel district	787,000,000		

forest land. This estimate seems too large considering that the bulk of the forests is now found in the northern provinces where the growth is very slow. An increment of about 25 cubic feet per acre of productive forest land, or a total increment of some 940,000,000 cubic feet, would seem to be a more probable figure.

Annual Cut.—The total annual cut is placed at 1,316,664,000 cubic feet. Of this, 162,037,000 cubic feet is cut in northern Finland and 1,154,627,000 cubic feet in southern Finland. The average cut per acre for Finland as a whole is 35.1 cubic feet; for northern Finland, 10.1 cubic feet; and for southern Finland, 53.9 cubic feet. Two-thirds of the total cut is sawlog timber. In northern Finland this has formed practically the entire cut, because the facilities for the transportation of small logs are undeveloped and costly.

Domestic Consumption.—At a cut of 1,316,664,000 cubic feet and an export of 316,160,000 cubic feet, with practically no imports (about 1,000,000 cubic feet), the amount of wood actually consumed within the country is in the neighborhood of 1,001,504,000 cubic feet, or 299 cubic feet per capita. Of this, two-thirds is in the form of sawlog material and one-third in the form of firewood.

Imports.—A small quantity of wood, consisting chiefly of the better grades of hardwoods, is imported into Finland for furniture, shipbuilding, and similar purposes. On an average the import in any one year was not more than about one million cubic feet, and in most cases it was much less. Most of the wood that is imported, although it comes through different countries, is of American and European origin, the other countries merely acting as re-exporters.

Export Trade of Finland.—The annual export of timber from Finland amounts on an average to 316,160,000 cubic feet, or 24 per cent of the total cut. The export by kinds is shown in Table 56.

TABLE 56.—EXPORTS OF TIMBER FROM FINLAND

Kind of product	Cu. ft.	Per cent
Sawn timber	114,015,000	36.0
Round timber (logs, masts, etc.)	18,348,000	5.8
Hewn timber	10,986,000	3.5
Railway ties and similar stock	2,118,000	0.7
Props	64,189,000	20.3
Pulpwood	17,962,000	5.7
Firewood, pine and spruce	6,318,000	2.0
Firewood, hardwoods	20,034,000	6.3
Total	253,970,000	

To this must be added the export of wood pulp and paper, amounting in 1913 to 319,610,000 kilograms, which in round timber is equal to 60,690,000 cubic feet, or 19.2 per cent of the total export, and about 1,500,000 cubic feet, representing the export of manufactured wood.

During 25 years the lumber export trade of Finland increased from 47.5 per cent of the value of all exports in 1888 to 70.5 per cent in 1911. In 1912 it reached a record figure of nearly $45,000,000. Of all the forest products exported, charcoal, tar, moss and cones, bark, and tree seed constitute only 0.7 of one per cent, while pulp and paper form 27.1 per cent and lumber 72.2 per cent. The export of forest products before the war was distributed between the different consuming countries in the following order: Great Britain, France, Germany, Holland, Belgium, and Spain. Just before the war Finnish forest products began to reach even such remote markets as South Africa, Australia, and others.

Export of Lumber.—By far the most important item of export is sawn lumber. The fluctuations in the export of lumber are shown in Table 57.

TABLE 57.—EXPORTS OF LUMBER FROM FINLAND

Year	Cu. ft.	Year	Cu. ft.
1903	92,908,695	1908	90,155,175
1904	93,124,020	1909	98,104,875
1905	95,573,445	1910	106,129,485
1906	103,373,160	1911	104,593,665
1907	94,007,760	1912	113,972,430
Average for 5-year period	95,797,416	Average for 5-year period	102,591,126

From these figures it may be seen that in the five-year period from 1908 to 1912 the average annual export of sawn lumber from Finland increased over the five-year period from 1903 to 1907 by 6,793,710 cubic feet, or 7 per cent. By countries the export of lumber in 1912, which amounted to 113,972,430 cubic feet, was distributed as shown in Table 58.

TABLE 58.—EXPORTS OF LUMBER FROM FINLAND BY COUNTRIES

Exported to	Cu. ft.	Per cent
England	25,300,770	22.2
France	20,049,480	17.6
Germany	19,428,420	17.0
Belgium	11,256,960	9.9
Holland	10,657,515	9.3
Spain	7,133,445	6.3
Denmark	4,509,285	4.0
Other countries	15,636,555	13.7

Export of Pulp and Paper.—The production of wood pulp, pasteboard, and paper has been greatly developed within the last 20 or 30 years. The conditions for the development of a pulp industry are extremely favorable. Finland has abundant water power, vast quantities of small spruce timber, and finally, cheap and very efficient labor. Aside from utilizing small spruce timber for wood pulp production, within recent years many pulp plants have been started in conjunction with sawmills, the refuse from which is being used for pulp making. The export of wood pulp and paper for the period from 1888 to 1912 increased more than 20 times in value. The increase was especially great in the three-year period between 1910 and 1912. Thus in 1911 the export of pulp and paper amounted to 284,900,000 kilograms (50,284,850 cubic feet of standing timber). In 1913 it rose to 319,610,000 kilograms (60,690,000 cubic feet).

It may be expected, in view of the favorable conditions for production, that exports of pulp and paper from Finland will continue to increase. It is possible even to expect that as the large-sized timber in the Finnish forests suitable for sawlog material becomes exhausted the pulp industry will gradually assume a predominant place. This may be inferred from a comparison of the growth of export of sawn lumber with that of pulp and paper products. Thus, while the export of sawn lumber in the period between 1888 and 1912 increased only four times, the export of pulp and paper products for the same period increased more than 20 times. Paper constitutes over 40 per cent of the pulp and paper export from Finland. The tendency in Finland is to increase the export of manufactured products, such as paper, in preference to the export of raw pulp. The export of pulp and paper products in 1912 was distributed among the different countries as follows: Russia 59.5 per cent; Great Britain 21.2; Germany 9.6; France 3.3; Belgium 2.9; Holland 2.2; and other countries 1.3 per cent of the value of pulp and paper products exported. It is of interest to note the great part which Finland played in supplying Russia with paper. As a matter of fact, before the war Finland supplied practically 90 per cent in quantity of all the pulp and paper products imported into Russia, or 75 per cent in value of the imports of these products. This was in spite of the fairly heavy import duty on Finnish pulp and paper products that existed in Russia before the war. Russia, which possesses vast spruce forests and water power in its northern provinces, will eventually develop its own pulp industry and become less dependent upon Finland for its pulp products. This will release large quantities of Finnish pulp and paper for the other markets of the world.

Export of Round Timber, Pulp Wood, and Props.—In spite of measures taken by the Finnish Government to discourage the export of small round timber for the reason that it comes chiefly from immature timber, the cutting of which has a bad effect on the forest, before the war this product constituted a large item in Finnish timber export, amounting to 9.2 per cent of the total value. The export of this kind of timber grew rapidly until 1908, when a law was enacted which imposed a heavy tax upon it, and recently an even more drastic tariff law has been enacted. In spite of these laws, however, the export of this product from Finland will continue. There is an abundant supply in Finland of small timber just suitable for props, pulp wood, and telegraph and telephone poles. As a matter of fact, in some localities, especially in small private holdings, this is the only kind of timber that is left. The owners of these forests will continue to utilize the resources of their forests for revenue.

Export of Hewn Timber.—Hewn timbers, beams, ties, etc., form a comparatively small item in the Finnish timber export. The export of this kind of timber has been somewhat reduced and has recently remained stationary. Hewn timbers exported are almost exclusively square and of different length. In the five-year period between 1906 and 1910 such hewn timbers were exported at an average rate of 7,000,000 cubic feet.

Export of Bobbins.—The export of spools for the textile industry is very considerable. In 1912 there were manufactured 9,768,312 spools, which were exported to England, Holland, Belgium, Russia, and other countries.

Export of Firewood.—The export of firewood varied comparatively little for the last 10 years before the war, and decreased somewhat toward the end of the period. In the five-year period between 1906 and 1910 it averaged 29,782,434 cubic feet annually. The largest amount, about 95 per cent, was exported to Russia by rail and was consumed chiefly in Petrograd. A small quantity of firewood is exported from southwestern Finland into Sweden.

Export of Other Forest Products.—Spruce and pine seed, birch and willow bark, moss, and charcoal, turpentine, tar, and other products of dry distillation are other forest products appearing in the list of Finnish exports. The most important products are charcoal and products of dry distillation. Lately, however, the export of turpentine and other products of dry distillation has greatly decreased. Thus in 1896 turpentine was exported to the amount of 22.5 metric tons and in 1908 it had dropped to 5.3 metric tons. Charcoal, on the other hand, shows a tendency to increase. In 1896, 536 metric tons of charcoal were exported, while in 1909 the export rose to 10,932 metric tons.

The Match Industry.—The match industry in Finland is not in a flourishing condition, first because the aspen which is used for the manufacture of matches is of better quality in Russia than in Finland, and further because of the past policy of the Russian government, which hindered the import of Finnish matches into Russia by import tariffs, while Russian matches had free access to the Finnish markets. Furthermore, Finland cannot develop a match industry capable of competing with that of Sweden.

Lumber Associations.—The Finnish lumber exporters have an association which controls in the aggregate up to two-thirds of the lumber export of the country. This association is modeled after the Swedish Association of Lumber Exporters. The Finnish and Swedish exporters form an international organization which is sufficiently strong to steady the prices on foreign markets.

The Probable Future.—The forest situation in Finland is summarized in Table 59.

Even allowing for a maximum annual increment of 33 cubic feet per acre and not allowing for waste due to fires, the deterioration of timber, and damage caused by insects and diseases, Finland is overcutting her forests. Another outstanding fact with regard to the forest situation in Finland is that the best managed forests are those owned by the state. These have always been cut conservatively and therefore still contain considerable reserves of large sawlog material. The private forests, and especially the farmers' woodlands, which in the past have been greatly overcut, now furnish chiefly small timber, mine props, pulp wood, and fuel wood. The value of these forests has greatly decreased.

TABLE 59.—FINLAND—SUMMARY

	Total forest area (productive acres)		Total annual cut	Total annual growth	Excess of cut over growth	Average annual export	Average annual import	Total domestic consumption
	State-owned forests	Private forests						
			cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
	13,170,286	24,352,812						
Total	37,523,098.0		1,316,664,000.0	1,242,000,000.0	74,664,000	316,160,000.0	1,000,000.0	1,001,504,000.0
Per acre....	....		35.1	33.1	2	8.4	....	26.7
Per capita..	11.2		393.0	371.0	22	94.0	0.3	299.0

In the absence of a rigid forest law regulating cuttings on privately-owned timberlands, the excessive exploitation of private forests will continue, to the detriment of the timber export of Finland. The Finnish, Swedish, and Norwegian exporters of lumber, realizing that large sawlog material within their own countries is greatly depleted, are restricting the output of such material for export trade and attempting to compensate the loss from a restricted output by higher prices for the timber that each country is allotted for export trade. Such a restriction of the output, while of advantage to Sweden and Norway, and to some extent to Finland, is against the interests of Russia, since the latter still has enormous quantities of large-sized timber and cuts far less than the actual increment. A concession to such a demand would doom to deterioration large overmature timber. For this reason Russian lumber exporters refused before the war to join the association of Scandinavian lumber exporters.

Although Finland will probably continue to increase her export of large sawlog material, this increase will involve a heavy drain upon the remaining resources, especially of the private forests which have been exhausted by previous cuttings. Finland's policy is to impose an increasingly larger import duty on round logs and pulpwood with a view to developing wood-using industries at home. The future of Finland will be not unlike that of Norway—a large increase of exports of wood pulp and gradual decrease of high-grade lumber and large-sized timber.

Forestry Movement.—A Department of Forestry has recently been established at the University of Helsingfors for the training of higher forest officers. The course lasts from two to three years. Only students who have had a preliminary training in mathematical, physical, and biological sciences are admitted. In addition, there are five forest ranger schools.

In 1917 a Forest Research Institute was established. The Institute publishes the results of its experiments, four volumes having thus far appeared. An inventory of the forest resources of the country is now being taken.

In 1917 a law was enacted directed chiefly toward preventing the cutting of immature forests and also toward preventing forest devastation. Under this law the manner of cutting in each section of the country is prescribed by local authorities. This, together with a high export tariff on small round timber, is to discourage the utilization of small trees except those which are to be thinned out under forest management. Whether this law will be effective in checking the overcutting of the Finnish private forests time alone can tell.

Recently the legislative body passed a law setting aside special forests. On the strength of this law large areas of forests in northern

Finland will probably be declared protection forests in which cuttings will be strictly regulated.

For the advancement of forestry among farmers the government gives subsidies to agricultural societies for maintaining forest advisers and arranging for prizes for the best work in forestry. There are two forest fire insurance societies. In 1920 over 5 million acres were insured against fire.

In 1909 the Forestry Society of Finland was founded for the advancement of the science of forestry. The Society has published twenty-one volumes of Acta Forestalia Fennica which contain material of considerable scientific value.

Revenue and Expenditure from State Forests.—The revenue from the state forests has been steadily growing since 1883. In 1900 the gross revenue was about $900,000 while in 1912 it was $2,600,000, or about a three-fold increase. In 1912 the net revenue was $1,600,000 while the expenditure was $1,000,000, or 8 cents per acre. The expenditures form 38 per cent of the gross revenue.

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FRANCE

Forest Area.—The total land area of France, including the island of Corsica, but not including Alsace-Lorraine, is 132,514,560 acres. The total forest area is 24,420,000 acres, or 18.4 per cent, or a per capita area of 0.63 acre. Of this, 1,246,589 acres are classed as unproductive, leaving a productive forest area of 23,173,500 acres. The total forest acreage by departments with the percentage of forests in each department is shown in Table 60.

The percentage of forests in the various departments differs widely. The average for the most heavily forested departments is a little over 38 per cent and for the least forested slightly less than 5 per cent. The

TABLE 60.—FOREST AREA OF FRANCE BY DEPARTMENTS

Department	Total acres	Per cent forested
Ain	314,359	21.9
Aisne	264,283	14.5
Allier	197,078	10.8
Alpes (Basses)	453,387	26.3
Alpes (Hautes)	364,728	26.0
Alpes-Maritimes	262,304	28.4
Ardèche	240,976	17.5
Ardennes	345,901	27.7
Ariège	430,718	35.7
Aube	332,734	22.4
Aude	192,294	12.3
Aveyron	198,361	9.2
Belfort (Territoire de)	51,269	35.0
Bouches-du-Rhône	211,820	16.3
Calvados	94,495	6.9
Cantal	163,385	11.5
Charente	204,602	13.9
Charente Inférieure	201,810	12.0
Cher	305,559	17.2
Corrèze	266,072	18.4
Corse (Corsica)	431,126	19.9
Côte d'Or	644,986	29.8
Côtes-du-Nord	80,072	4.7
Creuse	81,708	5.9
Dordogne	632,039	27.8
Doubs	375,127	28.6
Drôme	479,521	29.7
Eure	276,861	17.8
Eure-et-Loir	150,734	10.4
Finistère	73,010	4.4
Gard	372,021	25.8
Garonne (Haute)	222,878	14.3
Gers	118,837	7.7
Gironde	141,412	46.2
Hérault	209,332	13.6
Ille-et-Vilaine	109,462	6.6
Indre	199,176	11.8
Indre-et-Loire	236,469	15.5
Isère	504,011	24.6
Jura	423,060	33.8
Landes	1,276,561	55.4
Loir-et-Cher	355,050	22.3
Loire	133,664	11.4
Loire (Haute)	222,854	18.1
Loire-Inférieure	78,075	4.5
Loiret	318,896	18.9
Lot	268,395	20.8
Lot-et-Garonne	200,842	15.2
Lozère	182,069	14.3
Maine-et-Loire	139,958	7.8
Manche	48,304	3.2
Marne	453,439	22.5
Haute-Marne	483,546	31.5
Mayenne	74,731	5.8
Meurthe-et-Moselle	339,059	26.0
Meuse	457,271	29.8
Morbihan	114,676	6.8
Nièvre	478,584	28.4
Nord	105,822	7.5
Oise	252,992	17.5
Orne	200,231	13.3
Pas-de-Calais	88,211	5.4
Puy-de-Dôme	216,317	11.0
Pyrénées (Basses)	364,409	19.3
Pyrénées (Hautes)	211,553	18.9
Pyrénées-Orientales	216,950	21.3
Rhône	75,535	10.9
Saône (Haute)	428,902	32.5
Saône-et-Loire	348,175	16.4
Sarthe	208,077	13.9
Savoie	319,590	22.4
Savoie (Haute)	302,186	28.3
Seine	4,472	3.7
Seine-et-Marne	276,616	18.9
Seine-et-Oise	270,431	19.5
Seine-Inférieure	227,422	15.2
Sevier (Deux)	98,622	6.6
Somme	99,245	6.5
Tarn	203,767	14.3
Tarn-et-Garonne	117,654	12.8
Var	732,916	49.5
Vaucluse	238,757	27.0
Vendée	69,130	4.3
Vienne	205,915	12.0
Vienne (Haute)	117,102	8.6
Vosges	534,590	36.9
Yonne	410,756	22.4
Total	23,430,296	17.7

department of the Landes has the largest per cent under forest—over 55—and the department of Manche the least, only 3.2 per cent. The forest area in France has fluctuated considerably since 1790, as may be seen from Table 61.[1]

TABLE 61.—VARIATION IN FOREST AREA OF FRANCE

Year	Acres	Per cent
1760	37,050,000	28.0
1791	23,687,300	17.8
1803	22,521,213	17.0
1827	22,103,042	16.7
1844	21,699,691	16.5
1850	21,884,200	16.5
1908	24,667,149	18.7
1912	24,420,152	18.4

The figure for 1760, quoted from Mirabeau, is obviously exaggerated. It would be impossible under ordinary circumstances for 13,363,000 acres to disappear in 30 years. The decrease of 1,166,000 acres from 1791 to 1803 was due to the complete removal of restrictions on private exploitations.

Character of the Forest.—The forests of France fall naturally into two broad topographical divisions—plains forests and mountain forests. Coniferous species, as usual, predominate in the mountain regions and broadleaf species in the plains.

The forests of the plains fall into three regions—the Parisienne, the Gironde, and the Provençale regions.

The Parisienne zone takes in more than half of France. In the west it includes such forests as Fontainebleau, d'Orleans, and Montargis; in the center it includes the Sologne, and in the east the Argonne, the Langres Plateau, the Plains of Lorraine, Franche-Comté, and Bourgogne. It is characterized by broadleaf species, except where resinous trees have been artificially planted.

The Gironde region follows the ocean from Bayonne to the Loire, including the oaks of the Adour, and the maritime pine of the Gascon Landes. The principal species are maritime pine, occidental oak, and pyrean oak. Maritime pine is characteristic of the well-known forest of the Gascon Landes, an artificially planted forest covering approximately 1½ million acres of formerly waste land and shifting sand dunes,

[1] *Revue des Eaux et Forêts* for 1914, page 402.

and producing annually an average of 80,000 metric tons of turpentine and rosin, besides mine timbers.

The Provençale zone lies on the borders of the Mediterranean sea between Nice and Fort Vendres. The species predominating are holm oak, white oak, and Aleppo pine.

The mountain regions of France are five in number: the Vosges zone, characterized by forests of fir, beech, and spruce, with artificial plantations of Scotch pine; the Jura zone, very rich in forests, the chief commercial species of which are silver fir and Norway spruce; the Alps zone, with white and holm oak, chestnut, and Scotch pine in the lower regions, and mountain pine, larch, and Cembran pine at higher altitudes; the Central Plateau region, which includes the mountains of Morvan where beech is an important species, and the Cevennes, where Austrian pine is the predominant species; and the Pyrenees region, containing principally fir, beech, and mountain pine, with smaller quantities of spruce, larch, oak, chestnut, holm oak, and maritime pine.

According to method of management the productive forest area of France may be divided as follows:

	Acres	*Per cent*
Coppice	5,766,603	24.9
Coppice under standards	9,130,674	39.4
Under conversion from coppice to high forest	383,939	1.6
High forest	7,892,347	34.1
Total	23,173,563	100.0

Thus, only one-third of the total productive forest land in France produces sawlog material.

Composition.—There are no accurate figures on the percentage of area occupied by different species in private forests and in communal and institutional forests not under state control; estimates place the proportion of hardwoods for France as a whole at 80 per cent and conifers at about 20 per cent. In private forests conifers form 19 per cent and hardwoods 81 per cent. In the forests under state supervision conifers occupy 23.3 per cent of the total area and broadleaf forests 76.7 per cent, as may be seen from Table 62.

Total Stand of Timber.—The total stand of timber of France may be estimated in the neighborhood of 35 billion cubic feet, of which at most 40 per cent, or 14 billion cubic feet, may be classed as sawlog timber. The value of the French forests, including both soil and wood, has been estimated at $1,011,642,000. The average value of an acre of private forests is figured at $27.35.

TABLE 62.—COMPOSITION OF FORESTS UNDER STATE SUPERVISION

Species	Productive forest area	Per cent of total productive forest area	
	acres		
Broadleaved:			
Oak	1,796,000	27.4	
Beech	1,194,000	18.2	
Hornbeam	717,000	11.0	
Holm oak	264,000	4.0	
Miscellaneous	1,053,000	16.1	76.7
Conifers:			
Fir	455,000	6.9	
Scotch pine	430,000	6.6	
Maritime pine	262,000	4.0	
Spruce	178,000	2.7	
Larch	116,000	1.8	
Aleppo pine	30,000	0.5	
Miscellaneous	54,000	0.8	23.3
Total	6,549,000		100.0

Character of Ownership.—The character of ownership is shown in the following table:

	Acres	*Per cent*
State	2,962,615	12.1
Private	15,982,106	65.5
Communes and public institutions	5,475,431	22.4
Total	24,420,152	100.0

Table 63 shows the distribution of the state, private, and communal forests according to the method of management.

The state and communal forests thus include the largest area of unproductive forest land because the state and communes own most of the mountain slopes, where considerable areas cannot support tree growth. On the other hand, more than two-thirds of the private forests are nothing but coppice forests or coppice under standards, and less than one per cent of this area is being converted into high forest. Only one-third of all the French forests are under high forest. By far the greater part of the forests of France are thus in small holdings and private ownership. This fact is regarded as being of decided advantage to the stability of the French nation in contrast to conditions in the United States, for example, where over 79 million acres of forest lands

TABLE 63.—DISTRIBUTION OF FRENCH FORESTS ACCORDING TO METHOD OF MANAGEMENT

Ownership	Unproductive		Coppice		Coppice under standards		Under conversion		High forest	
	Acres	Per cent	Acres	Per cent	Acres	Per cent	Acres	Per cent	Acres	Per cent
State.	366,071	29.4	64,082	1.1	762,195	8.4	241,087	62.8	1,529,180	19.4
Private.............	610,644	49.0	4,854,162	84.2	5,854,471	64.1	106,269	27.7	4,556,560	57.7
Communes and public institutions........	269,874	21.6	848,359	14.7	2,514,008	27.5	36,583	9.5	1,806,607	22.9
Total.........	1,246,589	100.0	5,766,603	100.0	9,130,674	100.0	383,939	100.0	7,892,347	100.0

are controlled by about 1,800 men. But small private ownership, on the other hand, tends to cause the forests to deteriorate, owing to the lack of technical management and to unsystematic cutting. Private forests are to be found in every department of France, though in varying proportions. The department of Seine, which includes the city of Paris, has only 121 acres of private forests, while the largest proportion of privately owned forest land is located in the department of the Landes.

There are no state forests in the departments of Côtes du Nord, Dordogne, Lot, Lot-et-Garonne, Rhône, and Haute Vienne. The departments containing the largest area of state forests are Ariège, Alpes (Basses), Vosges, Côte d'Or, Loiret, and Drôme. Most of the unproductive state forest land lies in the mountain districts. The largest area of state forest in a single department is contained in the department of Ariège, where it comprises 47.7 per cent of the total forest area of the department. Lower Seine contains nearly 40 per cent, Basses Alpes 32 per cent, and Loiret 30 per cent, including the famous forest of Orléans.

Annual Growth.—The total annual increment is in the neighborhood of 890,000,000 cubic feet, of which 275,000,000 cubic feet, or 30.9 per cent, is sawlog material, and 615,000,000 cubic feet, or 69.1 per cent, is fuelwood.

With an annual increment of 890,000,000 cubic feet and a productive forest area of 23,173,500 acres, the annual yield per acre is approximately 38.4 cubic feet. The yearly wood production of France is much lower than that of Germany, owing to the prevalence in France of hardwoods managed as coppice and coppice with standards.

Annual Cut.—The total cut in round figures is 890,000,000 cubic feet, distributed as shown in Table 64.

This represents roughly a cut of 38.4 cubic feet per acre for the productive forest area and 22.8 cubic feet per capita of population. The outstanding fact is that the large saw timber comes chiefly from the state and communal forests, while the bulk of the smaller material, such as posts, poles, and especially firewood, comes from private forests. Of the total cut of 890,000,000 cubic feet, 275,000,000 cubic feet, or 30.9 per cent, is construction material, while 615,000,000 cubic feet, or 69.1 per cent, is firewood. Even of the construction timber large saw timber constitutes only 155,320,000 cubic feet, or 56.5 per cent of the total cut of this kind of material. Of the 615,000,000 cubic feet of firewood, part is used for the manufacture of charcoal, of which on an average 400,000 tons is produced annually.

Domestic Consumption.—The cut of timber in France, both of construction material and of small rough timber, such as mine props and telegraph poles, amounts on an average to 275 million cubic feet. In addition, 615 million cubic feet of wood is cut for firewood. The

TABLE 64.— AVERAGE ANNUAL TIMBER CUT OF FRANCE, ACCORDING TO OWNERSHIP AND KINDS OF PRODUCT

Kind	State forests	Communal forests	Private forests	Hedges	Total	Grand total	Per cent
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	
Construction material:							
Broadleaf:							
Oak, 20 inches and over	5,118,500	5,753,900	2,047,400		12,919,800		
Oak, less than 20 inches	5,118,500	7,589,500	18,567,800	21,180,000	52,455,800		
Other broadleaf species	6,212,800	3,812,400	6,865,850		16,891,050		
Posts and props	3,812,400	1,482,600	8,577,900		13,872,900		
Coniferous:							
Logs, 20 inches and over	9,566,300	12,955,100	21,709,500		44,230,900		
Logs, less than 20 inches	5,365,600	11,507,800	38,830,000		55,703,400		
Props, posts, etc.	458,900	776,600	56,409,400		57,644,900		
Poplar			21,180,000		21,180,000		
Total	35,653,000	43,877,900	174,187,850	21,180,000		274,898,750	30.9
Firewood:							
Hardwoods	56,480,000	111,724,500	373,597,550	14,120,000	555,922,050		
Conifers	7,060,000	8,224,900	43,207,200		58,492,100	614,414,150	69.1
Grand total						889,312,900	100.00

imports on an average for the three years from 1911 to 1913 amounted to 117,638,000 cubic feet; the exports for the same period totaled 70,175,000 cubic feet, or an excess of imports over exports of 47 million cubic feet in round figures. The total consumption, therefore, of both home-grown and imported wood amounts to 937 million cubic feet, or 24 cubic feet per capita. Of the 47 million cubic feet of wood imported in excess of exports, 38 million is classed as timber for construction and industrial use, and 9 million as fuelwood, excelsior, cork, and similar products. The total consumption of structural and industrial timber, therefore, is about 313 million cubic feet, or 8.0 cubic feet per head of population.[1]

In addition, there must be mentioned the import of pulp and paper, which in 1913 amounted to about 465,000 tons, or 86,446,700 cubic feet in the log. This is material which would be classed in France also as timber for industrial use. If the consumption of pulp and paper is added, the per capita consumption of saw timber and timber for industrial use becomes 10.2 cubic feet.

Imports and Exports.—The forests of France fall far short of meeting the wood requirements of the country, particularly lumber, of which from 30 to 40 per cent must be imported. The imports on the whole show a tendency to increase, but they fluctuate widely from year to year according to the economic conditions of the country. For the three-year period between 1911 and 1913, the last normal year, the import of saw timber and other timber for industrial use, except wood pulp, amounted to about 2,100,000 metric tons, or 117,638,000 cubic feet, valued at about $39,000,000.

Fernand Rouget estimated that in the period following the war the demand for saw timber and other timber for industrial use would greatly increase and would necessitate the importation of 282,400,000 cubic feet. At 66 cents per cubic foot it would amount to the enormous figure of $186,500,000. As may be seen from Table 65 (exports and imports) the chief article of import into France is squared or sawn timber and lumber, which forms two-thirds of the wood imported from abroad. The next item is resinous pulp wood, nearly 8 per cent of the wood imported. Of the three items, squared or sawn timber and lumber, stavewood, and resinous pulp wood, the imports exceeded the exports roughly by 88

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[1] According to Fernand Rouget, the consumption of construction timber and other industrial timber in France amounted in 1913 to 405,950,000 cubic feet, of which only 282,400,000 cubic feet was produced at home. Of the 282,400,000 cubic feet, only 155,320,000 cubic feet was saw timber. According to Rouget, therefore, the importation of this material in 1913 alone amounted in round figures to 123,550,000 cubic feet. As the post-war consumption he places the saw timber and industrial timber at 564,800,000 cubic feet, of which 282,400,000 cubic feet will have to be imported from abroad. This would indicate a per capita consumption of sawtimber and timber for industrial use alone of about 15 cubic feet.

TABLE 65.—FRENCH FOREIGN TRADE IN TIMBER (AVERAGE FOR 1911–1913)

Kinds of product	Imports			Exports		
	Metric tons	Cu. ft.	Per cent	Metric tons	Cu. ft.	Per cent
Round timber	78,266	4,422,029	3.8	187,481	10,592,676	14.7
Ties	29,161	1,647,596	1.3	48,901	2,762,906	3.8
Squared or sawn timber and lumber	1,395,587	78,850,666	66.3	79,903	4,514,520	6.3
Paving blocks	112	6,328	0.0	829	46,838	0.1
Stavewood	81,857	4,624,920	3.9	9,889	558,728	0.8
Splitwood	3,825	216,112	0.2	1,456	82,264	0.1
Hoopwood and manufactured vine props	1,073	60,624	0.1	13,855	782,808	1.1
Poles and props, unfinished	143,377	8,100,800	6.9	822,625	46,478,312	64.3
Cork	11,741	....	0.6	10,801	....	0.8
Fuelwood, fagots, and brushwood	25,150	1,420,975	1.2	60,273	3,405,424	4.7
Resinous pulpwood	164,339	9,285,154	7.9	493	27,854	0.0
Charcoal	4,062	....	0.2	25,657	....	2.0
Excelsior	1,401	....	0.1	191	....	0.0
Other common woods	143	8,080	0.0	839	47,404	0.1
Rare woods (squared and sawn, over 8 inches thick):						
Box	4,508	254,702	0.2	997	56,330	0.1
Mahogany	29,687	1,677,315	1.4	2,724	153,906	0.2
Others	35,970	2,032,305	1.7	7,429	419,738	0.6
Rare woods, 8 inches thick and less	5,719	323,124	0.3	3,465	195,772	0.3
Scented woods	626	35,369	0.0	59	3,334	0.0
Dye woods:						
Quebracho	36,349	2,053,718	1.7	205	11,582	0.0
Others	46,346	2,618,549	2.2	620	35,030	0.0
Total	2,099,299	117,638,366	100.0	1,278,692	70,175,426	100.0

million cubic feet. The annual exports for the three-year period 1911–13 amounted to 1,279,000 metric tons, or 70,175,000 cubic feet. The chief items of export were poles and props. They formed 64.3 per cent, or two-thirds of the entire wood export of France.

The kinds of wood imported, in the order of their importance, were as follows:

Construction timber other than oak and walnut
Common timber other than construction timber
Pulpwood
Tropical woods
Oak
Walnut
Articles made of wood.

Construction timbers other than oak and walnut consisted chiefly of fir. About 45 per cent of the imports were from Russia and about 40 per cent from Sweden. Pitch pines came from the United States, Austria-Hungary, and Germany, in the order named.

Common timber other than building timbers was imported as follows:

	Per cent
Oak stavewood from the United States	60
Oak stavewood from Russia	20
Stavewood of other species than oak, chiefly from Austria-Hungary	20

Russia furnished all the mine timber and 75 per cent of the resinous rough timber, and Germany 20 per cent.

Wood pulp (mechanical) was furnished by Sweden and Norway, 80 per cent; chemical wood pulp by Russia, 55 per cent, Germany 20 per cent, and Austria-Hungary 10 per cent. The principal sources of oak were Austria-Hungary, the United States, Russia, Rumania, and Germany. Walnut came in decreasing amounts from Turkey, and chiefly from the United States; walnut from the latter country is more and more in demand in the market, and much of it is being replaced by black and red gum.

What countries will participate in the future in supplying the French deficit of wood is somewhat uncertain. Rumania and Jugo-slavia will undoubtedly take the place of Austria in furnishing the oak and fir. Sweden and Russia will still continue to be important sources of supply for French needs. Germany will continue to supply, as part of the reparation, some of the timber needed by France. Larger quantities of timber will be coming from French colonies.

In view of the necessity of importing large quantities of construction timber from abroad there is at present a tendency in France to develop the timber industry of her enormous foreign colonies—the immense forests of French Africa or the more distant regions of Indo-China, Madagascar, or Guiana. The African colonies alone, which are only 15 or 20 days from French ports, are estimated to have an enormous supply of timber. At the present, however, the imports from the French colonies amount to only 5,650,000 cubic feet a year. It will be many years before France can make up even a considerable portion of her timber deficit by importations from her own colonies.

In this connection, the tests made in 1908 by M. Almeida, Chief Engineer of the Railway Company of the West on the comparative decay of colonial African woods, native French woods, and some imported woods, is of interest. M. Devaux, Professor of the Faculty of Sciences at Bordeaux, reported the results of these tests after the different species were left for eight years in ditches. The following species were tested:

African woods

African acacia (unknown leguminous species)
Mahogany (*Khaya ivorensis*)
Banda (*Cola proteiformis*)
Bilinga (*Sarcocephalus bilinga*)
Manioca
Kambala (*Chlorophora regia*)
Moabili (*Tieghennella heckelu*)
Okoume (*Aucoumea*)
Padouck (*Pterocarpus*)

Other woods

American mahogany
American western white pine
American pitch pine
American oak
Teak from Java
Fir from Sweden
Oak, walnut, elm, ash, beech, and poplar from France

The ditch in which the wood was placed for the test was opened eight years later and the samples examined. The results were as follows:

Of nine African woods tested only one showed any marked deterioration. All the others came out in good condition, most of them with the sheen still on them. These woods were all hard woods except one, *Aucoumea,* the resistance of which was really surprising. Among the native French woods, on the other hand, the only one which proved resistant, and that only in part, was oak. All other woods were rotted and several of them were in very bad condition, especially beech. Of the imported woods, the American woods stood the test still less satisfactorily, especially oak, which was very badly decayed. It was no longer wood but a mass of decomposed tissues. Pitch pine was also greatly affected. Teak showed a beginning of decay. This leads to the apparent conclusion that the African species are superior to species of the temperate climate and even to teak, which so far has been regarded as decay-proof. These results, together with numerous trials made by the Railway Company of the West of the possibility of using the woods of the Ivory Coast and the French colonies in the construction of rolling stock, which on the whole gave satisfactory results, assure, according to the claims of the foresters in the French colonies, a future field of usefulness for the French colonial tropical woods. So far, however, colonial timbers have been received in France with some indifference, if not skepticism. The colonial timbers require somewhat different methods of manufacture, an obstacle which is difficult to overcome. The colonies hesitate to undertake logging operations on a large scale for fear of losses to which the introduction of new species in France would expose them. Transportation charges and tariffs are high. Most of the timber dealers are averse to creating new demands and tastes among their customers, either because they themselves have interests involved or because they do not wish to run the risk of possible dissatisfaction on the part of their customers. Lack of knowledge of the properties of the timber from one colony to the other, confuse the ordinary dealer and customer. The delivery of the timber to the market in the form of logs or squared timber while green, carrying 50 to 60 per cent of waste at high freight charges, and finally the difficulty under such conditions, for exploiters of the colonial forests to find sufficient capital to create an important industry in colonial forest products, also hamper the wide use of colonial woods in France.

Revenue per Acre.—The average gross revenue per acre of French state forests is $2.76. The net yield per acre is $2.26, leaving 50 cents per acre as the cost of administration, protection, and management. The revenues and costs per productive acre in state forests are given by Huffel for a typical year as follows:

		Per cent of gross revenue
$2.26	Net yield	81.9
.06	Cost of management	2.2
.16	Cost of protection	5.8
.12	Maintenance	4.3
.16	Communal and departmental tax	5.8
$2.76		100.0

Wood-Using Industries.—Aside from the sawmill industry, which is operated on a very small scale in France, the naval stores industry and the paper industry are the two large industries dependent upon wood. The wood-using industries employ 710,000 people, distributed as follows:

Industries	
Joinery	153,000
Carpentry	94,900
Wheelwrights	82,700
Cooperage	46,600
Wooden shoes	52,400
Others	280,400

Sawmills.—The sawmill industry is particularly developed in southwestern France in the Landes region. In the year 1914 there were, according to the census, 142 sawmills in the maritime pine forests of the Landes, employing 1,735 men and 331 women. The output of these sawmills consists chiefly of pitwood, most of which is exported to England. Pine from the Landes is much preferred by the British for mine timber, and the annual export for this purpose is about 20,000,000 cubic feet.

Railway ties and paving blocks are also cut and treated by the mills of the Landes region, and boxes, parquet flooring, carpentry timber, and all kinds of fuelwood, are also manufactured.

Naval Stores.—The naval stores industry of the department of the Landes is represented by 115 mills and gives employment to 25,000 laborers. These plants range from the simple old-fashioned "crude" distilling mills to the thoroughly up-to-date, fully equipped, steam-distilling plants. Generally speaking, the commercial products of distillation consist of 15 to 20 per cent turpentine, 65 to 75 per cent rosin, and 5 to 10 per cent byproducts. The average annual production of turpentine under normal conditions is estimated at 55,115,000 pounds, and that of the dry products at 220,460,000 pounds. This is about four times as much as the output of Spain, and one-fifth as much as that of the United States. The home market consumes from 26,455,200 to 33,069,000 pounds of turpentine and 77,161,000 to 88,184,000 pounds of dry products. The remainder, or about one-half, is exported.

There are a number of subsidiary industries based upon the byproducts of the turpentining industry, among which the manufacture of oils, varnishes, glues, synthetic perfumes, printing inks, resinous soaps, and pitch are the most important.

Paper Industry.—The production of paper in France, as in all European countries, has shown remarkable growth. Thus while in 1886 the production of paper amounted to 180,497 metric tons, in 1890 it reached 365,000 metric tons, and 450,000 in 1900. Today the production is estimated at 867,000 tons. Allowing 176½ cubic feet of wood for each

TABLE 66.—IMPORTATIONS OF WOOD PULP INTO FRANCE

Kind	1898	1908	1911	1912	1913
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Mechanical pulp....	11,429,800	21,669,100	23,656,300	28,978,000	32,040,800
Chemical pulp......	10,631,600	36,733,300	45,601,900	49,257,300	54,405,900
Total........	22,061,400	58,402,400	69,258,200	78,235 300	86,446,700

metric ton of paper this amounts to an annual consumption of wood of 153,025,500 cubic feet in the log. With the increase in the production of paper the importation of mechanical and chemical pulp has also been increasing, as may be seen from Table 66.

By countries of origin the importation of wood pulp in 1912 and 1913 was as shown in Table 67.

TABLE 67.—IMPORTS OF WOOD PULP INTO FRANCE

Mechanical Pulp

Country	1912	1913
	tons	*tons*
Russia	14,292	15,380
Sweden	86,580	116,342
Norway	123,172	115,923
Germany	5,168	6,396
Canada	4,015	4,504
Other foreign countries	1,395	834
Algeria	16	....
Indo-China	2	70
Total	234,640	259,449

Chemical Pulp

Country	1912	1913
	tons	*tons*
Russia	4,257	995
Sweden	68,262	88,802
Norway	32,672	31,830
Germany	39,873	42,716
Holland	2,803	1,345
Belgium	4,288	4,665
Switzerland	4,878	4,606
Austria-Hungary	25,724	26,536
United States	2,706	2,711
Other foreign countries	589	1,293
Total	186,052	205,499

Allowing 123½ cubic feet of wood for one metric ton of dry mechanical pulp and 264¾ cubic feet for one metric ton of dry chemical pulp, the importation amounted to 86,446,700 cubic feet in the log in 1913.

Forest Laws.—Forestry laws and ordinances enacted in 1827 are still in force with slight modifications. Special legislation has since been passed for the French colonies, and for regulation of fishing and hunting, for fixing and maintaining dunes and correction of erosion in mountain lands, for organizing and policing the forests, and so forth. While the forest code of 1827 is thought by some to be out of date, its provisions are strict and clearly understood, and a change to less stringent laws would probably not be wise.

Laws regulating clearing of privately owned timber land are very stringent. No private owner may clear his timber without giving the sub-prefecture at least 4 months' notice of his intention, and permission may be refused after the timber has been examined and a detailed statement made out. The forest may be cleared only after this report has been submitted to the prefect, the forest agent of the department, and the Minister of Finance. The penalty for violation of this law is a minimum fine of $39.07 and a maximum of $117.21 per acre of cleared timber. The offender may also be compelled by the Minister of Finance to replant the cleared area within not more than three years.

Losses Through Fire and Other Agencies.—There is little danger from forest fires in France, excepting in the resinous and brush forests of the south. The law on this point, which covers all classes of forests, forbids the use of fire within 650 feet of forests during the period from June to September, without special permission. Owners of uncleared forest land may be compelled to maintain a fire line along the boundary between their land and similar adjoining land. Railroads are obliged to maintain fire lines 66 feet from each rail, at their own expense.

The losses caused by game, grazing, fungi, and wind are comparatively slight. Frost, hail, and ice on the trees cause considerable damage, however, and the effects can be offset only by using very hardy species as shelters for more sensitive trees.

Education.—A state forest school was established in 1824 at Nancy for the training of officers of the French Forest Service. Only graduates from polytechnic schools or from the Institute of Agronomy are admitted to this school, which has a two-year course. The ranger force is trained at Barrès. Guards are trained at Nogent-sur-Vernisson (Loire et Cher). Forest courses are also given at the Polytechnicum and at the Institute of Agronomy. There are a number of important forest associations which aim at protecting and popularizing French forests. These are:

(1) Académie d'Agriculture de France, of Paris, interested in all branches of agriculture and having a silviculture section which specializes in all general forestry questions, such as physiology, development of trees and stands, wood utilization, management, reforestation, etc. It is interesting to see forestry made an integral part of agriculture.

(2) Association Centrale Pour l'Aménagement des Montagnes, of Bordeaux, specializes in restoring mountain areas by improving grazing lands, in creating woodland on poor ground, and in reforesting mediocre grass land.

(3) Club Alpine Français, of Paris, furthers the reforesting of denuded mountains.

(4) Comité des Forêts, of Paris, a syndicate of forest owners, has to do with the improvement of private forest property, and especially its administration and exploitation.

(5) Société des Agriculteurs de France, of Paris, entirely independent of the Government, is active in all branches of the theory and practice of agriculture and silviculture.

(6) Société Forestière Français des Amis des Arbres, which has a section at Paris and affiliated sections in the departments, conducts propaganda for the improvement and creation of forests, planting of fruit trees, and betterment of grazing lands. It also supplies seed and planting stock to its members.

(7) The Société Forestière de Franche-Comte et Belfort, of Besançon, aims to improve technical methods and furthers reforestation on uncultivated land and grass land.

(8) Société Gay-Lussac, of Limoges, organizes a congress each year on "Trees and Water."

(9) The Touring-Club de France, of Paris, has a section of "Land and Forests," which conducts an active campaign for preserving beautiful forests, reforestation, reclamation of eroded mountains, and general forest improvement.

ALSACE-LORRAINE

With the return of the "lost provinces" of Alsace and Lorraine, France has recovered valuable forest property which had been wisely developed by the German forest administration during the 41 years of alienation. Alsace-Lorraine therefore deserves especial consideration.

Area.—The forest area of Alsace and Lorraine is 1,088,267 acres, or 30.3 per cent of the total land area. It is distributed among the three political divisions of the country as follows: Lower Alsace, 308,029 acres, or 28.3 per cent; Upper Alsace, 393,328 acres, or 36.1 per cent, and Lorraine, 386,910 acres, or 35.6 per cent. This is a per capita area of 0.62 acre, nearly the same as that of France (0.63) and Germany (0.54 acre). The proportion of forest to total land area in Alsace-Lorraine is somewhat lower than the average for Europe, which is 31.1 per cent, and much higher than the percentage of France, 18.4 per cent.

Table 68 shows the area under forest at different periods under the German régime.

TABLE 68.—AREA OF FORESTS IN ALSACE-LORRAINE

Year	Domanial	Joint	Communal and belonging to public establishments	Private	Total
	acres	*acres*	*acres*	*acres*	*acres*
1871	330,686	44,450	492,842	234,475	1,102,453
1881	330,790	42,454	496,144	231,227	1,100,615
1891	324,620	40,256	498,182	222,520	1,085,578
1901	343,283	40,142	498,098	219,618	1,101,141
1910	342,826	40,145	....	215,043	....
1916	340,616	41,486	498,184	207,981	1,088,267

During the German occupation clearings were authorized on only 19,325 acres, and 13,911 acres were reforested. Hence the total forest area of the country has changed little since 1871. Most of the decrease is due to fellings made for war purposes. An area of 2,366 acres was cleared for an artillery polygon and converted into an aviation camp, and several thousand acres were cleared near the town of Bitche for the same purpose. These clearings were partly compensated for by reforestation of inferior land, and certain acquisitions of private forests have helped to make up to the state for the loss.

Character of the Forest.—The forests of Alsace-Lorraine are of diverse character from every standpoint. In the plains are stands of broadleaf species, including oaks, beech, hornbeam, etc., and Scotch pine. Fir predominates in the mountains, with beech, Scotch pine, ash, and others. Natural growth of spruce is rarely found except in the upper portion of the valley of Munster, near the neck of the Schlucht. One interesting fact from the standpoint of plant geography is that natural stands of Scotch pine are to be found in the plains of Alsace. This species, which during the quaternary period was very common in the part of France west of the Vosges, has now become a mountain species in that region; in the northeast of Europe, on the other hand, Scotch pine is a plains species covering vast areas in Russia, in the Scandinavian countries, and in northeastern Prussia.

The distribution of the forests of Alsace-Lorraine conforms with the best economic use of the land. They are found chiefly on the least fertile land, and in regions where the configuration of the ground and the severity of the climate make agricultural pursuits difficult, if not impossible.

Two-thirds of the forests of Alsace-Lorraine are broadleaf and the remaining third coniferous. This proportion resembles that of the forests of France, and is quite different from that of Germany, where coniferous species occupy 67.5 per cent of the total forest area. Oak represents about 11 per cent, Scotch pine about the same, and fir nearly twice as much. The government forests contain more oak, and the communal forests more fir, than the average.

Character of Ownership.—In Alsace, as in France, most of the public forests are owned by the communes, while in Lorraine government forests predominate. Only one-fifth of the total forest domain is in private hands, in marked contrast to France, where about two-thirds of the forest lands are privately owned. Table 69 shows the percentage of forest area in the different provinces by ownership.

TABLE 69.—CHARACTER OF FOREST OWNERSHIP

Class	Upper Alsace	Lower Alsace	Lorraine	Total	
	per cent	*per cent*	*per cent*	*acres*	*per cent*
State forests	18.6	25.0	45.2	325,049	29.9
Forests owned jointly (State and communes)		9.4		28,955	2.6
Communal forests	67.4	47.4	27.6	509,393[1] 8,503[2]	47.6
Private forests	14.0	18.2	27.2	216,367	19.9
				1,088,267	

[1] Communes.

[2] Public institutions.

The distribution of the forests by ownership is most remarkable, especially in the Haut-Rhin, where over two-thirds of the forests belong to the communes. This situation resembles that in Switzerland, and probably has a similar historic origin. Generally speaking, it may be said that the importance of the local forest domain is in proportion to the intensity of human activity, the degree of development of local liberties and institutions in ancient times, and especially the custom of collective ownership, which was long retained by the Germanic tribes who settled in the southern part of Alsace, while it was abandoned very early in their history by the Romans, Celts, and Franks.

Alsace-Lorraine contains 1,698 communes, two-thirds of which own forests. Two of these communes own more than 12,350 acres each, while 430 own from 49 to 247 acres. Part of the forests now owned by the state belonged originally to the domains of local sovereigns (for example the ducal forests of Lorraine), and especially to ecclesiastical foundations, whose holdings reverted to the state in 1789. Only one forest, now owned jointly by the state and the town of Haguenau (33,837 acres), was originally owned by the Holy Roman Empire. The forest of Wissembourg formerly belonged to the famous Benedictine abbey of that town, but after long discussion it was finally recognized as the joint property of the town and the abbey.

Most of the private forests are of contemporary origin, from alienations of state property. Some of them are ancient seignorial forests. As in most of France, the majority of private forests are in very small holdings, 96 per cent containing less than 25 acres. Considering the communal and private ownership together, 96.2 per cent of the total holdings are forests less than 25 acres in extent, representing only 7.1 per cent of the whole forest area. The situation in this respect is better than in the part of France west of the Vosges, where 1,444,800 private owners, or 94.5 per cent of the total number, own forests of less than 25 acres, the area of which equals 36 per cent of the total area of private forests. While the average area of privately owned forests is 10 acres in France proper, it is 17 in Alsace-Lorraine, 12 in Bavaria, 12 in Saxony and Wurttemburg, and 35 in Prussia. In the Prussian government of Pomerania the average area is 79 acres. Private forests of more than 247 acres form more than four-fifths, and those of over 2,470 acres 22 per cent of the total.

Annual Growth.—There are no data on the yield of the private and communal forests of Alsace-Lorraine. It was estimated in 1900 that all the forests of the country produced annually 50 cubic feet per acre of wood over 0.8 inch in diameter. The statistics on the state forests, on the other hand, are complete. For the first 25 years of the German occupation, the average increment per acre per year of the state forests and those owned jointly by communes and states was 60 cubic feet, of which 46 cubic feet consisted of wood over 0.8 inch in diameter. Construction timber represented one-third of the whole volume. The figures have varied scarcely at all since that time, except for the proportion of large timber, which during the few years just preceding the war represented 45 to 48 per cent of the total volume. The following percentages show the relative amounts by species: oak, 17 per cent; other hardwoods, 50 per cent; and conifers, 33 per cent. The proportion of coniferous woods to the total volume is continually increasing.

The annual increment of all wood must be close to 70 cubic feet, since the cut, according to the estimates of 1900, produced about 70 cubic feet per acre and did not as a rule exceed the capacity of the forest. The annual increment for the entire country, therefore, may be accepted as in the neighborhood of 73 million cubic feet, of which two-thirds was fuel wood and the remaining one-third was building timber. Half was produced in the state forests and the other half in communal and private forests.

Annual Cut.—The annual cut never exceeded about 48 million cubic feet of fuelwood and 25 million cubic feet of construction timber, or a total of about 73 million cubic feet, and as a rule was less than that. The average cut per acre may thus be considered as about equal to the annual increment.

Domestic Consumption.—The wood imports of Alsace-Lorraine in 1913, the last normal year, amounted to about 11 million cubic feet, or 2 million cubic feet in excess of exports. At an annual cut of about 73 million cubic feet and a net import of 2 million cubic feet, the total domestic consumption is equal to 75 million cubic feet, or about 42.9 cubic feet per capita, and of saw timber and other industrial timber about 15.2 cubic feet.

Imports and Exports.—Most of the imported wood produced came from Austria, Sweden, and Germany. One of the characteristic features of the wood imported into Alsace-Lorraine is the large amount of fuel. It is evident that Alsace-Lorraine cannot export timber to France proper.

Wood-Using Industries.—The chief wood-using industries are the lumber industry and the manufacture of furniture, flooring, wooden shoes, implement handles, shoe trees, vehicle bodies, billiard tables, and similar products.

Revenue.—The total net receipts in 1873 from state forests (and state forests held in undivided ownership) was $1,175,764, or $7.78 per acre forested; in 1913 the net total was $1,186,626, and the net per acre $7.65, or 13 cents less than in 1873. In 1918 the receipts had almost doubled because of war inflation. The revenue has been constant except in 1892 and 1902, when there were losses from windfall, resulting in an overstocked market and consequent low prices. There are no reliable data on the returns from private forests.

From 1907 to 1917, 304,895 acres of the state forests (about five-sixths of the total) were valued by the German service and totaled, with the actual growing stock, $78,735,237, or about $254.37 per acre. On the basis of the net revenue of $7.65 per acre this means a return of 3 per cent on the assessed capital invested.

Forest Management.—In contrast with the French forests, high forest occupies 64 per cent of the forest area. The conversion of many coppice forests into high forests reduced the production of fuel. This, within recent years, made necessary imports of firewood in large quantities. One deplorable practice in the opinion of the French foresters was that the Germans almost entirely disregarded natural reproduction. The forest practice followed by the Germans was clean cutting with artificial reproduction. Clean cutting and artificial reproduction involved the substitution of pines and spruces, which are easy to plant, for the broadleaf species.

TABLE 70.—FRANCE—SUMMARY

Division	Population	Land area	Forest area			Annual cut					
			Total	Per cent	Per capita	Total	Per acre	Fuelwood	Per acre	Sawlog	Per acre
		acres	*acres*		*acres*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
France.	39,000,000	132,514,560	24,420,152	18.4	0.63	890,000,000	38.4	615,000,000	26.5	275,000,000	11.9
Alsace-Lorraine. .	1,750,000	3,587,200	1,088,267	30.3	0.62	73,000,000	67.1	48,000,000	44.1	25,000,000	23.0
Total. . . .	40,750,000	136,101,760	25,508,419	18.7	0.63	963,000,000	39.7	663,000,000	27.3	300,000,000	12.4

Division	Annual growth						Excess of cut over growth		
	Total	Per acre	Fuelwood	Per acre	Sawlog	Per acre	Total	Fuelwood	Sawlog
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
France.	890,000,000	38.4	615,000,000	26.5	275,000,000	11.9	. . . .	. . . .	. . . .
Alsace-Lorraine. .	73,000,000	67.1	48,000,000	44.1	25,000,000	23.0	. . . .	. . . .	. . . .
Total. . . .	963,000,000	39.7	663,000,000	27.3	300,000,000	12.4	. . . .	. . . .	. . . .

TABLE 70.—FRANCE—SUMMARY—*Continued*

Division	Annual consumption						Excess of imports over exports		
	Total	Per capita	Fuelwood	Per capita	Sawlog	Per capita	Total	Fuelwood	Sawlog
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
France.........	937,000,000	24.0	624,000,000	16.0	313,000,000	8.0	47,000,000	9,000,000	38,000,000
Alsace-Lorraine..	75,000,000	42.9	48,500,000	27.7	26,500,000	15.2	2,000,000	500,000	1,500,000
Total....	1,012,000,000	24.8	672,500,000	16.5	339,500,000	8.3	49,000,000	9,500,000	39,500,000

The cut and growth per acre are based upon the productive forest area.

The Probable Future.—The forest situation in France, including Alsace-Lorraine, has been summarized in Table 70.

France before the war depended to a large extent on importations from abroad for structural material. The war, with its resulting devastation of the forests in the invaded territory and overcutting in most of the other forests of France, aggravated this situation. The immediate wood requirements of France for rebuilding of towns, railways, etc., will probably be furnished in part by Germany in the form of reparations and in part by the French colonies in Africa and Indo-China.

Whatever the future of the French colonies may be in supplying the needs of the mother country in construction timber, for many years to come France will have to depend on importations from Russia and Sweden and the countries of southeastern Europe which formerly constituted the Austro-Hungarian Empire.

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GERMANY

Forest Area.—Before the war Germany possessed a forest area, in round figures, of about 35 million acres. This was nearly 26 per cent of the total land area and 0.62 acre per capita. By the terms of the Versailles treaty Germany lost about 4 million acres of its forest area, or 11.6 per cent, including the following:

	Acres
Alsace-Lorraine	1,088,267
Saar Region	165,500
Posen	1,432,135
West Prussia	1,386,620
Total	4,072,522

The areas now remaining to Germany are shown in Table 71.

TABLE 71.—FOREST AREA OF GERMANY BY STATES

State	Forest area		Acres
	Acres	Per cent	Per capita
Prussia	17,691,079	19.7	.42
Bavaria	6,166,384	32.5	1.00
Saxony	961,350	25.8	.22
Wurttemberg	1,501,039	30.8	.70
Baden	1,419,488	37.7	.75
Hesse	600,022	31.2	.52
Mecklenburg-Schwerin	591,851	18.0	.98
Saxe-Weimar	232,720	25.8	.65
Mecklenburg-Strelitz	155,561	21.2	1.52
Oldenburg	170,852	10.6	.42
Brunswick	273,682	30.1	.60
Saxe-Meiningen	259,649	42.1	1.02
Saxe-Altenburg	89,758	27.1	.45
Saxe-Coburg-Gotha	148,940	30.1	.65
Anhalt	144,486	25.1	.45
Schwarzburg-Sondershausen	66,777	31.0	.82
Schwarzburg-Rudolstadt	103,325	43.9	1.10
Waldeck	106,989	38.2	1.85
Reuss (elder line)	28,132	35.6	.40
Reuss (younger line)	77,994	37.8	.55
Schaumburg-Lippe	17,248	20.3	.40
Lippe	83,719	27.6	.60
Lübeck	10,207	13.7	.10
Bremen	120	.2	....
Hamburg	4,467	4.3	....
Total	30,905,839	23.8	0.49

The present forest area of Germany is thus about 31,000,000 acres, or 23.8 per cent of the total land area of the country (130,032,640 acres), and 0.49 of an acre per head of the population (63,000,000).

Character of the Forest.—Of the forests, 33 per cent are hardwoods and 67 per cent conifers. The constant tendency is to increase the latter at the expense of the former.

Character of Ownership.—Of the total area, the state forests comprise 30.1 per cent, crown forests 2.1 per cent, and communal forests 16.4 per cent, while institutions and associations own 4.1 per cent and private owners 47.3 per cent. In Table 72 is given a detailed statement

TABLE 72.—OWNERSHIP OF FORESTS, BY STATES AND PROVINCES

State	Crown forests	State and shared forests	Communal forests	Institutional forests	Association forests	Private forests	Total
	acres	*acres*	*acres*	*acres*	*acres*	*acres*	*acres*
Prussia	179,065	4,930,172	2,670,042	220,405	587,445	9,103,950	17,691,079
Bavaria	4,248	2,088,592	768,888	116,200	50,038	3,138,418	6,166,384
Saxony	160	434,650	57,750	25,070	1,612	442,108	961,350
Wurttemberg	16,205	468,790	445,488	36,318	18,388	515,850	1,501,039
Baden	20,658	240,145	639,515	47,362	5,038	466,770	1,419,488
Hesse	166,215	12,302	217,375	1,690	5,565	196,875	600,022
Mecklenburg-Schwerin	19,108	248,548	56,662	29,798	....	237,735	591,851
Saxe-Weimar	125	110,598	35,562	3,928	3,212	79,295	232,720
Mecklenburg-Strelitz	3,242	102,692	12,220	545	....	36,862	155,561
Oldenburg	932	64,362	18,065	1,400	48	86,045	170,852
Brunswick	....	200,965	4,065	632	44,692	23,328	273,682
Saxe-Meiningen	260	110,148	60,808	1,950	22,985	63,498	259,649
Saxe-Altenburg	28,098	15,545	1,905	2,360	1,258	40,592	89,758
Saxe-Coburg-Gotha	8,485	86,808	18,410	915	8,910	25,412	148,940
Anhalt	49,080	59,558	2,942	1,760	208	30,938	144,486
Schwarzburg-Sondershausen	41,872	350	8,570	625	7,155	8,205	66,777
Schwarzburg-Rudolstadt	....	48,875	11,560	1,170	2,122	39,598	103,325
Waldeck	....	66,888	23,008	498	1,975	14,620	106,989
Reuss (elder line)	10,852	....	300	680	....	16,300	28,132
Reuss (younger line)	41,250	35	2,565	1,712	12	32,420	77,994
Schaumburg-Lippe	16,208	....	2	10	....	1,028	17,248
Lippe	35,205	2,815	9,142	312	1,245	35,000	83,719
Lübeck	....	7,325	12	1,362	....	1,508	10,207
Bremen	....	....	....	....	....	120	120
Hamburg	....	2,648	282	22	....	1,515	4,467
Total	641,268	9,302,811	5,065,138	496,724	761,908	14,637,990	30,905,839
Per cent of total	2.1	30.1	16.4	1.6	2.5	47.3	100.0

showing the forest according to ownership in the different states and provinces.

Annual Growth.—Since the principle underlying the management of practically all the forests is to cut merely the annual increment and leave intact the forest capital, it may be safely assumed that the annual cut is equal to the annual growth. In some cases the annual cut has been kept below the annual increment, in order to increase the forest capital and produce larger annual increments in the future.

The total stand before the war is given in the "Wörterbuch der Volkswirtschaft" (Prof. D. L. Elster, Jena, Achte Lieferung, 1899), at a forest rotation of eighty to one hundred years, as 70 billion to 105 billion cubic feet. Prof. Elster assumes an annual growth of 50 cubic feet per acre. The average rotation may be taken as 90 years, but even this is too long, since there are many broadleaf forests which do not demand such long rotations. At an annual growth of 50 cubic feet and a rotation of 90 years, the stand of timber has been computed at about 79 billion cubic feet. Allowing 11 per cent for the loss in forest area, the present stand may be assumed to be 70 billion cubic feet. Even at an average price as low as 7 cents per cubic foot, the German forests still represent a capital of $4,900,000,000, not counting the value of the land.

Annual Cut.—The total cut before the war was 1,706,223,000 cubic feet, or 48.7 cubic feet per acre. This cut was distributed according to kinds of wood as follows:

Kinds of Wood	Actual amount	Total cut	Amount per acre
	cu. ft.	*per cent*	*cu. ft.*
Timber (*Nutzholz*)[1]	706,564,000	41.4	20.2
Firewood	630,032,000	36.9	17.9
Total of wood over 2¾ inches in diameter (*Derbholz*)[1]	1,336,596,000	78.3	38.1
Stump and fagot wood	369,627,000	21.7	10.6
Total production	1,706,223,000	100.0	48.7

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[1] *Derbholz* is a general term for all wood over 2¾ inches in diameter at the small end; therefore this term will cover saw logs, mine timber, posts, poles, and also such firewood as exceeds this dimension. *Nutzholz* applies only to sawlog timber, in distinction from all other kinds of derbholz.

Since the war Germany has lost an annual yield of wood equal to 164,202,000 cubic feet, as follows:

Region	Annual yield of wood	Of the total yield, construction timber was
	cu. ft.	*cu. ft.*
Alsace-Lorraine	55,541,020	27,774,040
Saar Region	6,812,900	3,883,000
Posen	53,338,300	37,700,400
West Prussia	48,509,260	32,624,260
Total	164,201,480	101,981,700

Alsace-Lorraine and the Saar region did not produce enough building material for their own needs, and depended upon import from other countries. The eastern provinces of Posen and West Prussia, however, produced large quantities of construction timber, and their loss will seriously affect the future forest management of Germany. Disregarding the loss of eastern Silesia and Schleswig, the cut of *Derbholz* in Germany as it remains amounts to 1,172,395,000 cubic feet. Of this 604,583,000 cubic feet is construction timber and 567,812,000 is fuelwood. It is possible that the estimate of 1,172,395,000 for the cut is too low, and that a better estimate would be 1,377,000,000 cubic feet, or 44.6 cubic feet to the acre. This means about 23 cubic feet per capita.

Domestic Consumption.—Before the war the annual import of wood reached 7,572,000 tons and the export 495,000 tons, leaving an excess import of 7,077,000 tons. This was equivalent to 564,800,000 cubic feet of timber in the log. With the decrease in territory and population the normal excess of imports over exports is now placed at 530,000,000 cubic feet a year, and the total consumption at about 1,702,395,000 cubic feet, representing 27 cubic feet per capita.[1] Of this 1,135,000,000 is building material and 568,000,000 fuelwood. In other words the per capita consumption of construction material is 18 cubic feet and that of fuelwood 9 cubic feet.

Imports and Exports.—In spite of the fact that before the war Germany was producing a larger amount of sawlog timber per acre than any other country of Europe, it was unable to supply its own needs. Since 1863 the imports have exceeded the exports and the difference between them has been growing steadily. Table 73 shows the steady increase in quantity and value of net imports of timber since 1880.

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[1] In addition, about 350 million cubic feet of stump and fagot wood is used, making the total consumption 2,050,000,000 cubic feet, or 32.5 cubic feet per capita.

TABLE 73.—GERMANY—IMPORTS AND EXPORTS BY CLASSES OF WOOD

Quantity

Classes of wood	Imports						Exports					
	1880	1890	1900	1905	1910	1913	1880	1890	1900	1905	1910	1913
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Round	69,063,744	108,627,984	143,865,856	153,202,000	183,986,876	191,379,543	26,178,480	11,070,080	10,313,248	7,393,232	13,396,491	12,319,474
Hewn	....	45,844,110	64,229,409	48,779,658	35,532,902	31,273,308	....	657,639	1,343,871	1,010,286	639,054	1,461,960
Sawed	51,667,551	68,394,456	156,556,206	165,715,497	182,786,948	182,557,060	34,797,681	8,177,598	12,390,300	8,663,679	8,642,615	10,284,616
Other wood	....	2,277,909	3,164,292	3,774,276	....	179,132,190	....	133,434	95,310	114,372	....	18,789,318
Total	120,731,295	225,144,459	367,815,763	371,471,431	402,306,726	584,342,101	60,976,161	20,038,751	24,142,729	17,181,569	22,678,160	42,855,368
Excess of imports over exports	59,755,134	205,105,708	343,673,034	354,289,862	379,628,566	541,486,733						

Value

Classes of wood	Imports 1880	Imports 1890	Imports 1900	Imports 1905	Imports 1910	Imports 1913	Exports 1880	Exports 1890	Exports 1900	Exports 1905	Exports 1910	Exports 1913
Round	$10,924,100	$13,494,600	$17,588,200	$20,420,400	$27,407,128	$30,983,792	$4,331,600	$1,856,400	$2,213,400	$1,547,000	$2,346,918	$1,923,992
Hewn	....	9,163,000	8,591,800	6,330,800	4,292,806	4,834,018	....	166,600	190,400	214,200	106,624	298,452
Sawed	7,163,800	8,544,200	26,775,000	27,346,200	32,329,206	36,618,680	5,640,600	1,428,000	2,641,800	1,523,200	1,935,892	2,876,706
Other wood	....	1,309,000	1,737,400	2,165,800	....	21,187,712	....	95,200	71,400	71,400	....	2,978,570
Total	$18,088,000	$32,510,800	$54,692,400	$56,263,200	$64,029,140	$93,624,202	$9,972,200	$3,546,200	$5,117,000	$3,355,800	$4,389,434	$8,077,720
Excess of imports over exports	$8,115,800	$28,964,600	$49,575,400	$52,907,400	$59,639,706	$85,546,482						

Round timber 1 ton = 56.48 cubic feet } in the log.
All others 1 ton = 95.31 cubic feet } in the log.

Distribution of Imports by Countries of Origin.—Russia was the biggest single supplier of timber to Germany before the war. It is of interest to follow the competition that took place between Russia and Austria-Hungary as providers of wood to Germany. Until 1899 Russia was leading Austria. From 1899 until about 1910 Austria assumed the leadership. After 1910, however, Russia again assumed the leadership, which it held up to the last year before the war. This leadership is even more overwhelming when the quantity of the imports and not the value is considered, since Austria exported more valuable products than Russia.

The import of wood before the war was distributed among the different countries in per cent of the total value as shown in Table 74.

TABLE 74.—GERMANY—IMPORTS OF TIMBER BY COUNTRIES OF ORIGIN IN PER CENT OF TOTAL VALUE

Country	1880	1890	1905	1910	1913
Russia	39.6	53.4	30.9	39.4	37.5
Finland			5.1	5.5	9.8
Austria-Hungary	37.4	29.3	32.6	24.3	20.9
Rumania	....	....	1.4	2.2	.6
United States	2.5	1.5	11.6	13.1	13.8
Sweden	4.7	11.7	15.8	12.1	11.3
Norway	2.0	1.8	1.3	.6	.4
France	....	....	....	.2	......
Netherlands	....	....	....	.5	.8
French West Africa	....	....	....	.5	1.3
Others	13.8	2.3	1.3	1.6	3.6

Imports by Classes.—If we consider the imports according to classes, more than half were in the form of round timber. In other words, Germany preferred raw material which was either re-exported to other countries or manufactured at home, and the surplus above her own needs was re-exported to western Europe as a manufactured product or in the form of pulp and paper. The chief suppliers of round timber were Russia and Austria. Since 1892 the import of sawn lumber has also been rapidly increasing. Until 1899 Sweden occupied the first place in the import of lumber into Germany, but since 1903 it has yielded the first place to Austria-Hungary. From 1886 to 1903 the import of sawn lumber from Sweden increased 268 per cent. Austria-Hungary was in keen competition with Sweden, and from 1886 to 1893 its export of sawn lumber increased 295 per cent. Russia occupies the second place as a supplier of sawn lumber (quantity). A rapid increase was shown in the import of this product from the United States. The import from

TABLE 75.—GERMANY—CLASSIFICATION OF TIMBER IMPORTS FROM DIFFERENT COUNTRIES, IN PER CENT OF THE VALUE IMPORTED FROM EACH

Country	1880		1890			1905			1910			1913	
	Round	Hewn and sawed	Round	Hewn	Sawed	Round	Hewn	Sawed	Round	Hewn	Sawed	Round	Hewn and sawed
Russia	88.7	11.3	49.2	39.4	11.4	58.0	19.1	22.9	59.6	9.0	31.4	63.0	37.0
Finland	......	......	......	......	......	......	13.9	86.1	......	14.7	85.3	......	100.0
Austria-Hungary	47.9	52.1	54.4	20.1	25.5	54.7	9.7	35.6	61.6	3.8	34.6	68.1	31.9
Rumania	......	......	......	......	......	......	......	100.0	......	......	100.0	......	100.0
United States	42.1	57.9	15.0	......	85.0	17.5	......	82.5	20.0	......	80.0	12.8	87.2
Sweden	......	100.0	......	16.9	83.1	......	7.8	92.2	......	9.9	90.1	......	100.0
Norway	......	100.0	......	......	100.0	......	......	100.0	......	......	100.0	......	100.0
France	......	......	......	......	......	......	......	......	100.0	......	......	......	......
Netherlands	......	......	......	......	......	......	......	......	......	......	100.0	......	100.0
French West Africa	......	......	......	......	......	......	......	......	100.0	......	......	......	100.0

Norway is of little importance, and its future share is excluded because of lack of raw material at home. Some imports appeared from Rumania, however. The import of hewn timber forms, on the whole, from 12 to 16 per cent of the total import. The export of such material was practically nil. Most of the hewn timber came from Russia rather than from Austria-Hungary, and a small amount from Sweden and the United States. The import of oak staves fluctuated comparatively little, amounting on an average to about 50,000 tons and the export to only about 2,500 tons. The oak staves came chiefly from Austria-Hungary, the United States, and Russia, named in the order of the amount.

Under "firewood" was undoubtedly included some pulp wood, especially that which came from Austria-Hungary and the Netherlands. The export of firewood went chiefly to Switzerland.

Pulp and Paper Imports.—Until recently, Germany was the greatest producer of paper in the world except the United States. Even today it occupies the third place, having been surpassed by Canada. In 1907 its production of paper was 1,292,850 tons; in 1913, 1,611,240 tons; and in 1920, 1,055,000 tons. Considering one ton of paper as equal to 176½ cubic feet of wood in the log, the paper industry of Germany requires annually between 200 and 250 million cubic feet of wood. Germany is unable to provide its paper industry with all the raw material necessary and therefore depends on importations of pulp and pulpwood from abroad. In 1920 the imports of wood pulp exceeded exports by about 370,000 tons, equivalent to 65,300,000 cubic feet of wood in the log. In addition, a considerable amount of pulpwood is imported which is classified as such, and also much pulpwood enters under the name of "firewood" and many pulp and paper plants obtain their pulp wood from logs. It is difficult, therefore, to determine accurately just what proportion of foreign pulp wood enters into the production of paper in Germany. It is probably safe to estimate that about half of all the pulpwood which is used in the manufacture of paper comes from abroad in one form or another.

Exports.—The export of forest products reached its highest point in the period between 1872-79. Since then it has dropped and remained almost on the same level. This decrease of export was due, first, to the increased consumption of wood within the country itself, and second, to the fact that Austrian and Russian wood, which Germany had been handling as an intermediary, is now finding more direct routes to the countries of consumption.

The future timber trade of Germany will be greatly handicapped by the necessity of delivering great quantities of wood to the victorious countries. Owing to the state of money exchange, it will also be necessary to export only sawn timber in order to make home production reach as far as possible and to restrict imports chiefly to round timbers.

The timber trade regions of Germany may be roughly indicated as follows:

1. East Prussia, now restricted to the part of Konigsberg reached via the Memel River. The entire Vistula region with its vast timber trade belongs to Poland, and the continuance of trade relations will hinge upon future agreements.
2. The Elbe region imports much round timber from Bohemia and saw timber from the Carpathians, and receives wood from America and elsewhere.
3. The Rhine and its tributaries carry Norway spruce and fir. Though this river has no present significance in export of timber, it does carry a heavy import from foreign countries.
4. The south German trade region is served by railways, and trade consists mainly of pine boards. This region is rich in forests—among them the famous Spessart, which produces the finest cabinet oak in the world. The Danube and its tributaries have little share in the wood trade.
5. The ports of Hamburg, Bremen, Lübeck, and Stettin receive most of the imports from foreign countries—pitch pine, American white pine, Douglas fir, cedar, and broadleaf timbers from the United States, Japanese oak from Japan, and jarrah, teak, cabinet woods, and dyewoods from the tropics. Bremen also receives much wood from Russia, Poland, Finland, Norway, and Sweden. Lübeck is the chief Baltic port for imports from Finland, Sweden, Poland, and Russia. Stettin receives soft- and hardwood logs and boards from the Baltic ports, tropical woods from Hamburg, and pulpwood and railway ties directly from Sweden, Finland, and Russia.

Revenue from State Forests.—Table 76 gives the gross income, expenditure, and net revenue per acre of several of the more important states of Germany for 1902. These figures show only slight increase

TABLE 76.—GROSS INCOME, EXPENDITURES, AND NET REVENUE PER ACRE

State	Gross income	Expenditure	Net income
Prussia	$3.08	$1.48	$1.60
Bavaria	4.23	1.96	2.27
Saxony	7.24	3.04	4.20
Wurttemberg	7.38	2.81	4.57
Baden	8.64	3.75	4.89
Brunswick	4.98	2.64	2.34

over similar figures of previous years. The figures for the years immediately before the war probably do not show much difference from those in 1902.

Forest Laws.—In nearly all of the German states there are laws which apply to so-called protection forests, that is, forests needed to prevent floods, sand blowing, and land and snow slides, or to insure regularity of water supply. Forests which fall under this category are under special control, and clearing may be forbidden except by permit. As to other privately-owned timberlands except those of the two smaller states of Baden and Wurttemberg, no restrictive laws exist. In Wurttemberg the laws of 1875 and 1879 provide that:

1. Clearing of private forests shall require a state permit; illegal clearing is punished with a fine.

2. A neglected piece of forest shall not become waste land. The state authority sees to its reforestation with or without the help of the owner, and the expenses are charged to the forest.

3. If the state forester is convinced that a private owner overcuts his forest or otherwise mismanages it, he is to warn the owner and, if this warning is not heeded, the forest authority may assume charge of the management of the forest in question.

By the law of 1875 the management and supervision of forests belonging to villages, towns, and other public corporations are placed directly under the state.

In Baden the private forests are similarly under the supervision of state authorities and though the private owner may use his forest very much as he pleases, he may in no way devastate or seriously injure it. Clearing requires a permit; bare and neglected spots in forests must be restocked. Failure of private owners to comply with the forest rules and laws leads to temporary management of the forest by the state authorities for not less than ten years.

Forest Education.—The larger states of Germany have forest schools for the training of their higher and lower personnel. In Table 77 are given the seven higher schools of forestry with the dates of their foundation, length of courses, numbers of teaching staff, and the average numbers of students attending them.

Probable Future.—The forests of Germany have been brought to as high a state of productivity as can probably be obtained. Germany, with its enormous industrial establishments, will continue to demand raw material from abroad in constantly growing quantities. The future of her forest industries and pulp and paper industry will depend largely upon her ability to obtain raw materials from Russia, Czechoslovakia, and Jugo-slavia, or the region which formerly composed the Austrian Empire. For a number of years she will have to supply French industries with a certain amount of timber. Her policy will be more and more to export only manufactured forest products, or reduce the export of

TABLE 77.—GERMAN HIGHER FOREST SCHOOLS

State	School	Date of foundation	Length of course	Teaching staff[1]	No. of students[2]
Prussia...	Forest Academy of Eberswalde	1830	3 years, preceded by at least one year's study at a university	13	67
Saxony...	Forest Academy of Tharandt	1816	As above	13	84
Saxe-Weimar..	Forest Academy of Eisenach	1830	2 years preceded by University study	10	78
Bavaria..	University of Munich, Forestry Dept.	1878	4 years	6 special forestry professors, 15 other university professors	121
Wurttemberg.....	University of Tubingen Forestry Dept.	....	....	3 special forestry professors 7 other university professors	33
Hesse....	University of Giessen, Forestry Dept.	1825	3 years	2 special forestry professors 11 other university professors	24[3]
Baden....	Technical University of Karlsruhe, Forestry Dept.	1832	4 years	3 special forestry professors 24 other professors	20
Total					427

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[1] Exclusive of assistants, "Privatdozenten," and other extraordinary teachers.

[2] Total enrollment for winter session 1910–11, including ordinary and extraordinary students.

[3] The total number of students in the Agricultural and Forestry Departments combined was 80. Separate figures are not available.

partially manufactured or raw material to a minimum. To what extent Germany will act as an intermediary in the export of raw materials from Russia and former Austria-Hungary to other countries will depend largely on the contact which those exporting countries may establish with the centers of consumption in Europe.

On the whole, the position of Germany will not differ much from that which she held before the war except that, with the loss of about 12 per cent of her forest territory—some of which produced a surplus of construction timber—and the necessity of paying part of her reparation costs in timber, she will depend on larger importations from abroad than her normal development would call for.

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GREAT BRITAIN—THE UNITED KINGDOM

Forest Area.—Three hundred years ago the British Isles were densely wooded. Even as late as the 13th century the land under cultivation amounted to barely 3,000,000 acres. By the 18th century, however, two-thirds of all the land in England had passed into private hands and was used for one or another form of agriculture. There still remained large areas of crown and communal woods. These, however, were left unprotected and continued to be devastated. During the 19th century, under the pressure of an enormous growth in population, the wooded area was still further decreased and the conversion of the remaining wooded land into other use was completed. Today the forests of the United Kingdom occupy but a small proportion of the total land area. Before the war the area of woodlands in the United Kingdom was estimated at 3,315,200 acres, or 4 per cent of the total land area. Table 78 gives the proportion of land used for different purposes.

Since the war, 300,800 acres have been transferred as a result of clearing from the "Merchantable" column to the "Unprofitable or inaccessible" column, reducing the merchantable forest from 83.6 per cent to 74.5 per cent of the total forest area, and raising the "unprofitable" forest area from 16.4 per cent to 25.5 per cent.

Over 81 per cent of the total land area is therefore under agricultural use. Of this, however, probably one-fourth is mountain and heath land which is utilized partly for sheep grazing and partly for hunting. These mountain and heath lands, because of their topography and the poverty of the soil, are not, on the whole, suitable for the cultivation of crops and therefore properly should have been used for forest purposes. The remaining 14.4 per cent of unclassified "Other land" is chiefly land in villages and cities, under roads and buildings, and in similar uses.

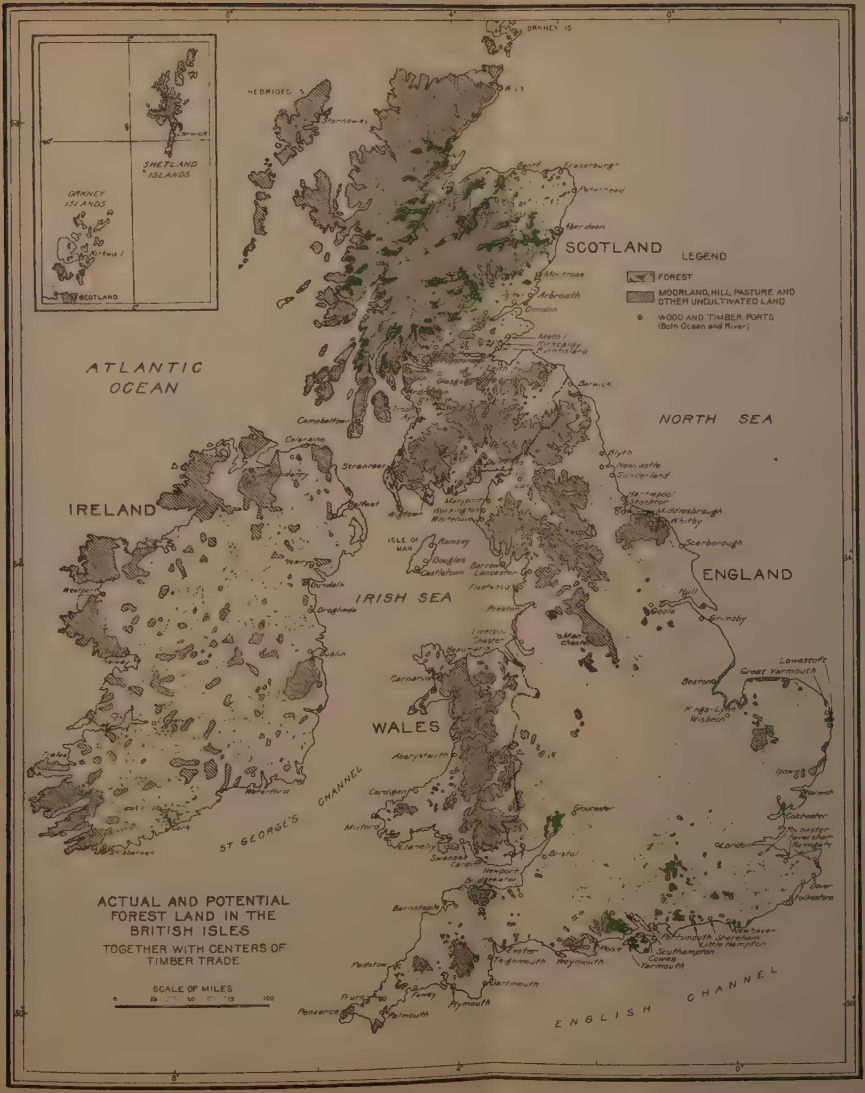
The distribution of the forest is given in Table 79, and the location of forests and of the land suitable for forest purposes is shown on the map. It appears that the counties of Sussex, Surrey, Kent, and Hampshire, in the southeastern part of England, and Elgin and Nairn in the northeast of Scotland, are the most densely wooded. The Islands of Man and Jersey are almost without forests.

Forest Area per Head of Population.—The United Kingdom has by far the least forest area per head of population of any country in Europe and with the exception of Denmark is the most poorly wooded. The forest area per head of population for the entire United Kingdom in 1913 was 0.067 acre. For England and Wales it was 0.052 acre, for Scotland, 0.182 acre, and for Ireland, 0.059.

Changes in the Forest Area.—Just before the war the area under forests was decreasing at the approximate rate of 1,000 acres a year. In Scotland replanting was not keeping pace with cutting, and the same was true, although possibly to a less degree, in England and Wales.

TABLE 78.—UTILIZATION OF THE LAND IN THE UNITED KINGDOM

Division	Agricultural land	Forest			Other land	Total
		Merchantable	Unprofitable or inaccessible	Total		
England and Wales:						
Acres	30,937,600	1,696,000	185,600	1,881,600	4,320,000	37,139,200
Percentage of total land area	83.3	4.6	0.5	5.1	11.6	....
Percentage of forest area	....	90.1	9.9	....	....	....
Scotland:						
Acres	13,932,800	857,600	281,600	1,139,200	4,000,000	19,072,000
Percentage of total land area	73.0	4.5	1.5	6.0	21.0	....
Percentage of forest area	....	75.3	24.7	....	....	....
Ireland:						
Acres	17,260,800	217,600	76,800	294,400	2,694,400	20,249,600
Percentage of total land area	85.2	1.1	0.4	1.5	13.3	....
Percentage of forest area	....	73.9	26.1	....	....	....
Total for United Kingdom	62,131,200	2,771,200	544,000	3,315,200	11,014,400	76,460,800
Percentage of total land area	81.3	3.6	0.7	4.3	14.4	....
Percentage of forest area	....	83.6	16.4	....	....	....



ACTUAL AND POTENTIAL FOREST LAND IN THE BRITISH ISLES TOGETHER WITH CENTERS OF TIMBER TRADE

TABLE 79.—DISTRIBUTION OF FORESTS BY COUNTIES AND PROVINCES

England

County	Forest area	Per cent of total under forest	County	Forest area	Per cent of total under forest
	acres			*acres*	
Bedfordshire........	12,542	4.1	Middlesex........	3,656	2.4
Berkshire...........	35,791	7.7	Monmouthshire....	32,733	0.9
Buckinghamshire....	32,125	6.6	Norfolk...........	53,870	4.0
Cambridgeshire.....	6,146	1.1	Northamptonshire...	28,017	4.3
Cheshire...........	24,838	3.4	Northumberland....	49,626	3.8
Cornwall...........	31,043	3.5	Nottinghamshire....	28,517	5.2
Cumberland........	35,054	3.6	Oxfordshire.........	26,611	5.5
Derbyshire.........	25,760	3.8	Rutlandshire........	3,838	3.9
Devonshire.........	86,050	5.1	Shropshire..........	50,493	5.8
Dorsetshire.........	37,615	6.0	Somersetshire.......	45,650	4.3
Durham.............	29,469	4.4	Staffordshire........	39,191	5.1
Essex..............	30,860	3.2	Suffolk.............	34,771	3.6
Gloucestershire......	58,407	7.2	Surrey.............	54,437	11.7
Hampshire.........	125,674	12.8	Sussex.............	124,632	13.3
Herefordshire.......	41,957	7.7	Warwickshire.......	21,261	3.6
Hertfordshire.......	24,545	6.0	Westmoreland......	17,334	3.4
Huntingdonshire....	4,714	2.0	Wiltshire...........	51,755	5.9
Kent...............	98,302	10.0	Worcestershire......	19,188	4.9
Lancashire..........	41,906	3.5	Yorkshire:		
Leicestershire.......	14,182	2.6	East Riding......	17,181	2.2
Lincolnshire........	43,127	2.5	North Riding.....	52,816	3.8
London.............	367	0.4	West Riding......	69,592	3.9
			Total........	1,665,741	5.18[1]

Wales

County	Forest area	Per cent of total under forest	County	Forest area	Per cent of total under forest
	acres			*acres*	
Anglesey...........	2,193	1.2	Flintshire...........	8,209	4.9
Brecknockshire......	13,956	2.9	Glamorganshire.....	27,206	5.2
Cardiganshire.......	15,989	3.5	Merionethshire......	14,407	3.4
Carmarthenshire....	23,290	3.9	Montgomeryshire....	24,730	4.8
Carnarvonshire......	12,593	3.4	Pembrokeshire......	9,698	2.4
Denbighshire........	18,422	4.3	Radnorshire........	10,917	3.5
			Total........	181,610	3.85[1]

TABLE 79.—DISTRIBUTION OF FORESTS BY COUNTIES AND PROVINCES.—*Continued.*

Scotland

County	Forest area	Per cent of total under forest	County	Forest area	Per cent of total under forest
	acres			*acres*	
Aberdeen	108,976	8.5	Kincardine	25,795	10.5
Argyll	48,412	2.3	Kinross	3,258	5.8
Ayr	25,725	3.5	Kirkcudbright	19,285	3.3
Banff	30,955	7.6	Lanark	21,499	3.7
Berwick	10,378	5.2	Linlithgow	5,206	6.7
Bute	3,806	2.6	Nairn	12,767	12.2
Caithness	952	0.2	Orkney	11	....
Clackmannan	3,026	8.5	Peebles	9,477	4.2
Dumbarton	8,772	5.1	Perth	94,103	5.7
Dumfries	31,531	4.5	Renfrew	6,661	4.2
Edinburgh	12,117	5.1	Ross and Cromarty	61,482	3.0
Elgin (or Moray)	48,688	15.7	Roxburgh	16,285	3.8
Fife	24,130	7.4	Selkirk	4,942	2.8
Forfar	31,972	5.6	Stirling	14,920	5.0
Haddington	10,472	6.1	Sutherland	19,641	1.4
Inverness	150,929	5.5	Wigtown	7,592	2.4
			Total	878,765	4.6[1]

Ireland

Province	Forest area	Per cent of total under forest	Province	Forest area	Per cent of total under forest
	acres			*acres*	
Leinster	94,309	2.0	Ulster	54,987	1.0
Munster	102,524	1.7	Connaught	51,203	1.2
			Total	303,023	1.56[1]

[1] These figures are not quite the same as those given in Table 78. They were obtained for different years. The discrepancy, however, is so slight that the value of the figures showing the distribution of forests by counties and provinces is not impaired thereby.

During the war it was estimated that about 300,800 acres were cut over, so that the total forest area in the United Kingdom is now only about 3 million acres. In Ireland during the period between 1851 and 1907 the forest area decreased by 2,168 acres. The largest increase (29,600 acres) occurred between 1851 and 1880; the greatest decrease (23,600 acres) between 1880 and 1891. The decrease has been continuous since then, being 4,900 acres between 1891 and 1905.

Ownership.—The United Kingdom has the smallest percentage of forests under state control of all the European countries. Of the total area of approximately 3,315,200 acres under forest, some 85,760 acres, or 2.6 per cent, are crown lands. In England and Wales 65,280 acres, or 3.5 per cent of the forests, are crown lands; 1,280 acres (0.1 per cent) in Scotland, and 19,200 acres (6.5 per cent) in Ireland. In England, Wales, and Scotland, the state lands are under the control of the Officer of Woods, and in Ireland under the Department of Agriculture and Technical Instruction. A few thousand acres are also in possession of the War Office, the Ecclesiastical Commission, and other public departments. The remaining 96.4 per cent, or 3,194,240 acres, is in the hands of large private owners.

TABLE 80.—CLASSIFICATION OF THE FOREST AREA BY OWNERSHIP

Division	State			Corporate	Private	Total
	Dedicated to timber production	Other forests	Total			
	acres	*acres*	*acres*	*acres*	*acres*	*acres*
England.......	48,640	16,640	65,280	34,560	1,781,760	1,881,600
Scotland.......	1,280	....	1,280	640	1,137,280	1,139,200
Ireland........	19,200	....	19,200	....	275,200	294,400
Total....	69,120	16,640	85,760	35,200	3,194,240	3,315,200

Character of the Forests.—*Species.*—The climate of the British Isles is very well suited for timber growth. There may be recognized three distinct zones based on the mean temperature during the month of July and the character of trees prevalent in each zone. The first zone comprises the greater part of the north of Scotland. It is characterized by a mean temperature for July of 54-56° F., and by the occurrence in commercial sizes of such species as silver fir, Norway spruce, European larch, and birch. The second zone embraces southern Scotland and the northern parts of England and Ireland. It has a mean July temperature of 57–59° F., and the commercial species of the zone are Scotch pine and several of the other conifers, as well as ash, beech, sycamore, and maple. The third zone embraces most of Wales and southern England and Ireland. It has a mean July temperature of 60-62° F., and the typical species are oak, English elm, Spanish chestnut, cedars, walnut, maple, and black locust.

With the exception of walnut and locust, all the species of the three zones occur more or less throughout the entire United Kingdom, but with the extension toward the north the species of the third zone become less frequent and of smaller development. Thus north of Yorkshire, elm is less abundantly distributed and does not reach the same dimensions as in the southern zone. Maples and cedars are comparatively rare and of poor development in Scotland. Walnut and chestnut when planted do not ripen their fruits and locust does not occur as a timber tree in Scotland and Ireland. The same three zones as observed in the latitudinal distribution may be observed altitudinally. Thus the first one corresponds to localities situated at a height of from 800 to 1,000 feet above sea level. The other two zones occur at lower levels. Latitude and protection against winds are the determining factors in relegating the vegetation at the lower elevations to the second or third zone. One characteristic of the distribution of forests in the United Kingdom is that above an elevation of 1,500 feet the forest vegetation becomes extremely poor. In Continental Europe at similar elevations there still occur dense forests. The reason for such poor growth in the United Kingdom must be sought in the devastating effect of the western winds to which the western slopes of the coast mountains of Scotland, Ireland, and Wales are exposed. These winds retard growth, and make trees gnarly and the stands very thin. The eastern slopes, on the other hand, protected from the winds, are covered with splendid forests. Table 81 gives some idea of the sizes attained by the different species in the United Kingdom. These figures are rather for exceptional trees which have grown up under very favorable conditions at elevations within 500 or 600 feet above sea level.

TABLE 81.—HEIGHT GROWTH OF SEVERAL SPECIES IN THE UNITED KINGDOM

Species	England	Scotland	Ireland
	feet	*feet*	*feet*
Ash	130–160	100–120	100–110
Beech	110–120	100–110	100–120
Oak	100–120	80–100	80–100
Larch	100–120	120–140	120–140
Spruce	100–130	100–120	100–120
Silver fir	120–140	100–120	110–130
Scotch pine	80–100	60–80	80–100
Douglas fir	100–120	100–120	100–120

The heights of forest trees in England are lower than the heights of the same species at the same latitude and altitude in Continental Europe. Thus oak in the Spessart, Germany, reaches a height of 150 feet at 1,000 to 2,000 feet above sea level, and silver fir in the Vosges Mountains of France reaches 144 to 163 feet at an elevation of 3,000 feet.

The principal timber trees native and introduced to the United Kingdom are:

Scotch pine (*Pinus sylvestris*)
Weymouth pine (American white pine) (*Pinus strobus*)
Norway spruce (*Picea excelsa*)
Silver fir (*Abies pectinata*)
Larch (*Larix europaea*)
Douglas fir (*Pseudotsuga taxifolia*)
Oak (*Quercus robur*)
Beech (*Fagus sylvatica*)
Sweet or Spanish chestnut (*Castanea vesca*)
Ash (*Fraxinus excelsior*)
Elm (*Ulmus campestris*)
(*Ulmus montana*)
Birch (*Betula verrucosa*)
(*Betula pubescens*)
Hornbeam (*Carpinus betulus*)
Alder (*Alnus glutinosa*)
Sycamore (*Acer pseudoplatanus*)
Walnut (*Juglans regia*)
Poplars (several species of *Populus*)
Willows (several species. The most important is *Salix alba* var. *coerulea.*)

Several other species introduced have been planted extensively but have not yet reached merchantable size. Among these may be mentioned Corsican and Austrian pine (*Pinus laricio*), cluster pine (*Pinus pinaster*), and Sitka spruce (*Picea sitchensis*).

Management.—According to the mode of origin the forests of the United Kingdom may be grouped into coppice (including coppice with standards), plantations under 10 years old, and other woods. In Table 82 are given the areas based on the returns made in 1905 and 1913 for England, Wales, and Scotland.

These figures indicate that for Great Britain the area of coppice decreased by 8,320 acres between 1905 and 1913. The area of plantations increased by 15,360 acres, the area of other woods decreased by 39,040 acres and the total area of woodlands by 32,000 acres. No particular reliance is placed on these figures because they are based on incomplete and voluntary returns.

The forests in Ireland were classified in 1914 as 95,680 acres, or 32 per cent, conifer; 70,950 acres, or 24 per cent, broadleaf; and 121,000 acres, or 41 per cent, mixed conifer and broadleaf. Five thousand one hundred and twenty acres were classified as coppice or scrub. Of the area under forest 76 per cent was enclosed and 24 per cent open to grazing.

The broadleaf, mixed conifer and broadleaf, and coppice forests grow in England chiefly in the southern and western districts. The counties of Sussex, Hampshire, and Surrey contain 18 per cent of all forests of the country and 60 per cent of these forests are coppice or coppice with standards. Scotch pine is the predominant species on the sandy soils of Surrey and Hampshire. Larch is very widely distributed but is commonest in the hilly districts of southwest England and Wales. In Scotland two-thirds of the forests are situated in the northeast and highland districts. Along the east coast, namely, in the valleys of Dee and Strathspey, Scotch pine is the predominant species. On the west coast larch is the most plentiful of the conifers. Large stretches of poor oak are still to be found on practically the whole west coast of Great Britain. In Ireland the forests are chiefly centered in the south. The native forests have there been replanted to a considerable extent with conifers and especially with larch.

The existing forests in Great Britain and Ireland may further be roughly classified into two large groups: (I) Remnants of the original forest and old plantations, and (II) plantations formed during the last 50 to 60 years. Group I may be further sub-divided into: (1) estate forests and ornamental plantations, usually in the form of shelter-

TABLE 82.—ACREAGE OF COPPICE, PLANTATIONS, AND OTHER FORESTS

Division and year	Coppice	Plantations	Other woods	Total
England and Wales:	*acres*	*acres*	*acres*	*acres*
1905	553,600	68,480	1,277,440	1,899,520
1913	540,800	76,800	1,266,560	1,884,160
Scotland:				
1905	23,040	35,200	810,240	868,480
1914	27,520	42,240	782,080	851,840
Total—Great Britain:				
1905	576,640	103,680	2,087,680	2,768,000
1913 (approximate)	568,320	119,040	2,048,640	2,736,000

belts near the residences on large estates; (2) old oak copse woods or coppice under standards, the remnants of those formerly worked for timber; (3) old oak copse formerly worked for bark and now usually either interplanted with conifers or else forming scrub oak woods which include an admixture of self-sown birch, alder, willow, and so on. Group II consists of: (4) plantations usually of coniferous trees made for the express purpose of forming game coverts or else to act as shelterbelts, and managed chiefly for the preservation of game; (5) plantations of larch, pine, and fir formed on poor land and mainly with a view to profit. There are no reliable figures as to the relative area or proportion of each of these five main classes of woodlands, but it is probable that not more than one-fourth to one-third of the existing forests and plantations were intended to be worked primarily for profit.

There is no systematic attempt made to secure good results and continuity in management for most of the forests in the United Kingdom. The estate forests are chiefly in the immediate vicinity of large residences and are of a more or less ornamental character. They often include a splendid growth of oak, ash, beech, elm, larch, Scotch pine, Douglas fir, silver fir, spruce, and other kinds of trees, some of which have attained unusually large and fine dimensions. In forests of this kind the removal of timber is usually confined to windfalls or to overmature and diseased trees.

The copse woods, or coppice under standards, which was the natural form of forest management in the United Kingdom and especially typical of the warmer portions of England, have been largely transformed into game coverts, yet these coppice forests were at one time among the most profitable parts of large estates. The coppice is usually cut once in 10 to 12 years, or at longer intervals. It consists mostly of hazel, though also of oak, ash, and birch, sometimes of beech, locally of hornbeam, in marshy woods frequently of alder and willow, and often of Spanish chestnut, particularly in the hop-growing districts of Kent. In most of the coppices there are standard trees, usually oaks. The prevalent type of copse is oak-hazel copse. It is by far the commonest form of woodland over wide areas in southern England, owing to the great demand in the past for hazel for hurdles, fencing, cask hoops, and so on, and for oak timber for the navy and various other purposes, as well as for oak bark used in tanning. These timbers have now greatly diminished, and in some cases became practically extinct during the latter half of the 19th century. The woods are still maintained, however, because of their convenience for game coverts.

Technical Qualities of the Principal Timbers of the United Kingdom.—The technical qualities of the wood of trees grown in the United Kingdom are considered by some inferior to those of Continental

TABLE 83.—MAXIMUM MECHANICAL VALUES OF HOME-GROWN TIMBERS[1]

A.—Softwoods

Popular name	Botanical name	Number of tests	Sites		Specific gravities—range	Bending			Compression—mod. rupt.	Factor of efficiency
			England	Scotland		$\frac{E}{10^6}$	E. L.	Mod. rupt.		
Scotch pine	*Pinus sylvestris:*									
	(a) Heavy timber	251	171	80	0.510–0.760	2.590	7425	15,600	10,100	221.7
	(b) Light timber				0.375–0.500	1.890	5225	11,800	7,440	238.4
Weymouth pine	*Pinus strobus*	10	10	......	0.420–0.550	1.710	6700	14,550	8,890	259.0
Cluster pine	*Pinus pinaster*	11	11	......	0.410–0.590	1.380	4000	10,200	7,030	204.8
Silver fir	*Abies pectinata*	16	16	......	0.370–0.520	1.740	5200	8,850	6,030	201.0
Norway spruce	*Picea excelsa*	23	21	2	0.300–0.520	1.950	6281	10,550	6,680	199.4
Larch	*Larix europaea*	38	30	8	0.450–0.750	2.420	6825	16,000	9,140	195.3
Douglas fir	*Pseudotsuga taxifolia*	5	1	4	0.450–0.550	1.849	6234	10,620	7,356	211.4

B.—Hardwoods

Beech	*Fagus sylvatica*	32	32	......	0.610–0.750	1.975	5250	14,700	7,240	165.7
Oak	*Quercus robur*	62	62	......	0.600–0.813	2.180	5380	14,750	8,850	181.8
Sweet chestnut	*Castanea vesca*	30	30	......	0.440–0.600	1.315	4125	10,950	7,350	196.3
Birch	*Betula spp.*	37	15	22	0.530–0.786	2.090	6760	13,911	9,420	202.6
Ash	*Fraxinus excelsior*	10	10	......	0.550–0.780	1.830	5350	16,400	8,330	205.4
Elm	*Ulmus spp.*	14	9	5	0.570–0.794	2.090	6910	14,180	10,010	200.0
Poplar	*Populus spp.*	1	1	......	0.480	1.320	2980	11,000	5,690	189.8
Sycamore	*Acer pseudoplatanus*	1	1	......	0.570	1.240	3175	10,000	5,530	155.5

Units are in lbs. per square inch except in the case of specific gravity.
E. = Modulus of elasticity.
E. L. = Elastic limit.
Mod. rupt. = Modulus of rupture.

$$\text{Factor of efficiency} = \frac{\text{Compression.}}{\text{Density.}}$$

The mechanical values are of the fully seasoned wood.
The specific gravities are of the absolutely dry wood.

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[1] Forestry in the United Kingdom, London, July, 1920, p. 17.

Europe. At least the wood-using industries prefer imported timber because of its better quality and better manufacture. This, however, may be due not to the inherent qualities of the wood itself, but to the manner in which the timber is grown.

Table 83 shows the maximum mechanical values of timbers grown in the United Kingdom.

Annual Cut, Growth, and Consumption.—*Cut.*—The total annual cut of timber, including hedge-grown timber, in the United Kingdom just before the war, has been estimated at 45,000,000 cubic feet, of which 30,000,000 cubic feet was conifers and 15,000,000 cubic feet hardwoods. According to the last Agricultural Census (1908) the cut in England, Wales and Scotland was as shown in Table 84.

Table 84.—Cut of Sawlog Timber in England, Wales, and Scotland in 1908 by Species

Species	Cu. ft.	Value
Larch	3,709,000	$700,776
Pine	3,895,000	394,186
Spruce and other conifers	587,000	58,398
Oak	3,604,000	1,153,360
Beech	1,349,000	248,192
Ash	598,000	180,060
Elm	583,000	102,196
Birch, maple, etc	520,000	72,998
Total	14,845,000	$2,910,166

Of this, 8,191,000 cubic feet was coniferous timber and 6,654,000 cubic feet hardwoods. These figures refer only to sawlog material. Firewood, tanbark, and products from thinnings represented a value of some $973,300.

In Ireland alone the entire cut for the same year was as follows:

Table 85.—Cut of Both Sawlog and Other Timber in Ireland in 1908

Species	Cu. ft.	Species	Cu. ft.
Larch	2,700,000	Beech	2,600,000
Pine	1,850,000	Maple	100,000
Spruce	550,000	Elm	200,000
Oak	2,050,000	Others	2,050,000
Ash	1,000,000		
Total			13,100,000

The value of the entire cut in Ireland was estimated at $632,645. Although there are no means of comparing the cut of 1908 with that immediately preceding the war, there was probably not much difference. The prices for home-grown timber during 1909–1913 were low and therefore cutting was discouraged. Since the total cut for the United Kingdom is 45,000,000 cubic feet and for Ireland alone about 13,100,000 cubic feet, the cut for England, Wales, and Scotland of both sawlog timber and cordwood must be 31,900,000 cubic feet. Since nearly 15,000,000 cubic feet of this is sawtimber, 17,000,000 cubic feet must be small-sized wood, such as pitwood and small thinnings. If the same ratio applies to Ireland, then the amount cut in Ireland would be about 6,200,000 cubic feet of sawtimber and 6,900,000 cubic feet of small-sized wood. For the entire Kingdom the cut would be represented by 21,000,000 cubic feet of sawlog material and 24,000,000 cubic feet of cordwood and other small-sized timber, with a total value close to $5,000,000.

Gross Increment.—According to the statement prepared by the Forestry Commission for the British Empire Forestry Conference in 1920, the total gross annual increment during the period 1909–13 was 52¾ million cubic feet and in 1919–20 a little over 41½ million cubic feet, or a difference of approximately 11 million cubic feet in favor of the period 1909–13. This decrease in the annual increment is due to the extensive cuttings that took place during the war. The losses of increment were especially great in the coniferous forests, precisely the kind of forest in which the United Kingdom is particularly deficient. With a total forest area of some 3,315,200 acres, the gross annual yield per acre before the war was 16 cubic feet; after the war, only about 12½ cubic feet.

Loss from Fire and Decay.—No accurate data are available on which to base an estimate of the annual loss from fires, waste, decay, and so on. On the whole, with the wet climate of the United Kingdom, the loss from fire is usually not serious. The proportion of timber which is allowed to decay in the forest is also not great. It is believed that 10 per cent of the gross annual increment is a reasonable figure to allow for all the sources of loss.

The Net Increment.—The annual increment on the entire forest area after deducting for loss from fire and decay on the basis of 1909–13 figures would be 47,475,000 cubic feet, while on the basis of 1919–20 figures it would be 37,350,000 cubic feet, or less than 11½ cubic feet per acre. It may therefore be reasonable to assume that the growth before the war was somewhat above the cut while during and since the war the growth has been less than the cut. During the war the total cut was estimated at 750,000,000 cubic feet, or equivalent to more than 15 times the pre-war net annual increment. The total cut during 1919–20 was estimated at 80 million cubic feet, or more than double the net increment. If this overcutting continues, the increment per acre is bound to decrease still further.

Consumption.—The 45,000,000 cubic feet cut annually in the United Kingdom forms but a small fraction of the total wood consumption in Great Britain. The home-grown timber barely met the needs of

TABLE 86.—TIMBER IMPORTED PER HEAD OF POPULATION

Year	Cu. ft.	Total imports	Year	Cu. ft.	Total imports
		cu. ft.			*cu. ft.*
1851	3.50	93,350,000	1891	8.50	331,200,000
1861	4.50	136,000,000	1901	10.50	474,000,000
1871	6.50	207,750,000	1911	10.50	487,000,000
1881	8.50	294,000,000	1913	13.50	580,000,000

TABLE 87.—WOOD AND TIMBER IMPORTED INTO THE UNITED KINGDOM
Average for Five Years, 1909–13

	Cu. ft.	Value
Hewn:		
1 Fir, pine and spruce	27,119,800	$6,586,190
2 Oak	8,098,520	6,401,579
3 Teak	1,974,640	4,029,462
4 Unenumerated	2,631,920	1,207,904
Total	39,824,880	$18,225,135
Sawn:		
6–9 Sawn or split	356,353,380	$84,508,505
11 Furniture woods—mahogany	6,366,780	4,304,989
12 Furniture woods—unenumerated	11,624,640	6,138,739
Total	374,344,800	$94,952,233
Small material:		
Pit props	147,213,600	$17,079,473
Staves	9,655,980	3,870,814
Woodpulp	85,945,100	19,750,681
Total	242,814,680	$40,700,968
Grand total	656,984,360	$153,878,336

England even as early as the beginning of the 18th century. By the end of the 18th century the United Kingdom was already a large importer of timber. The imports of unmanufactured timber for the period 1909–13 averaged 571,039,260 cubic feet a year. Export of domestic timber, on the other hand, and the re-export of foreign or colonial unmanufactured timber barely amount to 6,740,000 cubic feet—an insignificant quantity. The annual cut in the United Kingdom is 45,000,000 cubic feet. Deducting the exports, the total consumption of unmanufactured timber in the United Kingdom must be in round figures 610,000,000 cubic feet. With a population of some 45,371,000 the per capita consumption of unmanufactured timber alone is therefore about 13½ cubic feet. If, however, to this be added the imports of manufactured timber such as wood pulp, toys, games, brooms, brushes, furniture, and other miscellaneous articles, the total per capita consumption will be as high as 16 or even 17 cubic feet.

The consumption of wood in the United Kingdom is not evenly distributed. Thus, while in England the per capita consumption is probably close to 17 cubic feet, in Ireland it is only about 5 cubic feet. The per capita consumption of home-grown timber is a little less than one cubic foot. The per capita consumption of imported unmanufactured timber is therefore 12½ cubic feet. Although the consumption of home-grown timber has undoubtedly decreased within the last 60 to 70 years, it could not have been in 1850 more than twice or, at most, three times what it is now, or about 2 or 3 cubic feet. The growth of the per capita consumption of imported timber therefore reflects the increase in the per capita consumption of timber in the United Kingdom for that period. This is brought out in Table 86.

It is a fair deduction from these figures that the average individual consumption of timber has nearly quadrupled during 60 years and that the total consumption has increased six-fold for the same period. While it is only natural that the quantity of timber imported should increase with the growing population of the country, it is very significant that the requirements for timber have increased much more rapidly than the population. It is only reasonable to anticipate that the demand will increase still further in the future. Before the war the consumption of timber in the United Kingdom was increasing at the rate of about 5 million cubic feet per annum. In the next 60 years, therefore, if the rate of increase is maintained the consumption will be 300 million cubic feet above the present level, or close to a billion cubic feet. The increase in the per capita consumption in the United Kingdom controverts an opinion which has gained considerable ground that with the industrial development of a country the use of wood decreases. There are factors, such as the preservative treatment of wood and the substitution of other materials for structural purposes, which may tend to check the consumption of timber, but judging by the experience in the United Kingdom, it is a feature of modern commercial progress that in spite of substitutes and greater economies in the use of wood the consumption per capita is steadily increasing.

Revenue.—There are practically no official statistics as to the revenue, particularly net revenue, from forest lands in the United Kingdom. Forestry, as it is understood in Continental Europe, has not been in favor in the United Kingdom. The possibility of obtaining easily and cheaply forest products from foreign countries and also from its own possesions, together with the high rental value of the land, have caused land owners to consider forestry unprofitable. The absence of differential freight rates for the transportation of timber prevents native-grown timber from competing with imported timber. The cost of transporting timber from the Baltic countries into the United Kingdom is often cheaper than its transport within the boundaries of England itself. The heavy taxes, both local and state, the tax for the support of the poor, the income tax, land tax, and other taxes, all discourage the practice of forestry. To this must be added the scant trained forest personnel and lack of skilled timber workers.

For this reason many forest tracts have been managed more for the protection of game and the revenue obtainable from the latter. Not only many private forests, but even crown forests, are organized on this basis. Of the state forests only the Forest of Dean and the New Forest are managed on the same principle as the Continental forests. In most other crown and private forests game receives the first consideration. Deer, pheasants, and hare are particularly favored. Some of the wealthy owners of forest lands have transformed their forests entirely into deer parks. In such parks no timber is cut at all, or if cut the cutting is confined to localities and so timed as not to disturb the game. The annual revenue from hunting varies in England from $0.12 to $1.95 per acre. In Scotland the yearly revenue from hunting in large forest tracts at high elevations but on poor soils brings from $0.12 to $0.24 per acre.

Yet the revenue from English forests, when managed for timber production is, in some localities, relatively large, especially where the forests are organized by forest specialists. Thus the beech forests in Chiltern Hills have a gross revenue from $4.87 to $9.92 per acre per year. The management is selection forest with natural reproduction. Larch plantations in this region bring a very good revenue. At cost for planting from $29 to $49 per acre the final cutting, not including thinnings, brings from $389 to $584 per acre at a rotation of from 60 to 80 years. Some plantations bring an annual gross revenue of from $14.60 to $19.47 per acre. At Watlington and Stokinchurch mixed plantations bring an average gross revenue of from $6.57 to $9.73 per acre per year. In both places the revenue from the forest exceeds that from agriculture. In the forests belonging to Lord Beaconsfield a revenue as high as $973 per acre was obtained and the stand of mature saw timber ran as high as 2,000 cubic feet. Some figures from Yorkshire for mixed coniferous and broadleaf forests managed on a rotation of 75 to 80 years show a net annual revenue per acre of $9.73 (excluding the cost of growing, but including the cost of cutting and working up the timber into various grades).

In the forests of Scotland, located mostly on poorer soils than in England or Wales, there may be found also examples of high revenue from forests. Thus some exceptional forest tracts there brought before the war from $6.08 to $12.17 per acre per year. On the whole it is considered that in Scotland forestry may be profitable only on land whose annual rental is lower than $2.50 per acre. For this reason in many localities it is more profitable to manage forests for game than for timber production, as in Scotland the revenue from game is often six times greater than that from agriculture. These examples, however, are not the most common, and moreover they are gross revenues and gross revenues do not always indicate net revenues. Taxes on forest land in England and Wales before the war amounted to $1.22 to $1.82 per acre per year, depending upon the quality and location of the forest. Thus for each dollar of gross revenue the taxes are from $0.35 to $0.40, or 38 per cent. In Scotland the taxation is somewhat lower, and is determined according to a very complicated system which varies in different counties and electoral districts. On the other hand, the cost of cutting and hauling, because of the high cost of labor, is much higher than on the Continent. Thus felling costs about $0.009 per cubic foot and hauling from $0.008 to $0.009 per cubic foot. The freight rates, as already mentioned, are so high that home-grown timber can not compete with imported timber. In order to make the home-grown timber compete successfully with imported timber it would be necessary to establish high tariffs on imported timber. This would be contrary to the commercial interests of England as a whole, as the United Kingdom, being dependent on the importation of raw materials and a large exporter of manufactured goods, must essentially remain a free-trade country.

Stumpage Prices.—Average stumpage prices for saw timber of different species are as follows:

	Per cu. ft.
Oak and ash	$0.16–$0.24
Beech	0.10
Maple	0.12
Spruce	0.10
Larch	0.18
Elm	0.16
Alder	0.14
Pine	0.12

These prices may be considered as average for Wales and England. Prices are higher for forests more favorably located. Thus in the region of Chiltern Hills, which is not very far from London and is a large chair manufacturing center, the stumpage price of oak is as high as $0.61 per cubic foot.

The Sawmill and Wood-Using Industries of the United Kingdom.—In 1907 the United Kingdom made a census of production which included a statistical analysis of the lumber and wood-using industries. Although this census is not free from defects in classifying the different wood-using industries, it furnishes the only available official material regarding the lumber and wood-using industries in the United Kingdom. The census covers seven industries:

1. Sawmill industry.
2. Furniture industry.
3. Box, crate, and trunk industry.
4. Carriage, cart, and wagon industry.
5. Brush industry.
6. Stave and barrel industry (cooperage).
7. Basket and wicker work industry.

Leaving out the brush industry as one which does not properly belong to timber trades, the gross value of the product of sawmills and wood-using industries in Great Britain is represented by some $216,850,000, or 2½ per cent of the value of the product of all other industries of the United Kingdom. The number of workers engaged in these industries is 228,018, or 3.26 per cent of the entire number of workers engaged in English industries.[1]

The lumber and wood-using industries in England are mostly in the nature of large enterprises. The enterprises equipped with mechanical motive power engage 169,434 people and have an annual production of $180,683,000, while the small shops, having no mechanical motive power, employ only 58,584 workers and have an annual production of $36,167,000. The aggregate motive power employed in these industries is 171,698 horsepower. For a country that has a very small area of forests of its own, the lumber and wood-using industries of the United Kingdom are striking examples of industries that have been developed entirely on imported raw material.

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[1] *Final Report* of the First Census of Production of the United Kingdom (1907) Sec. XI—Timber Trades.

The Sawmill Industry.—The products of the sawmills in the United Kingdom represent a value of $81,850,000, or 37.7 per cent of all the wood-using industries of the country. The sawmill industry employs 78,223 workers, or 34.4 per cent of all the workers engaged in the wood-using industries. Unfortunately, as classified in the census of production, it includes in many cases other enterprises such as furniture making, wood-turning, and some others. The actual product of the sawmills alone, therefore, would be somewhat less, probably not more than 24 per cent of all the the wood-using industries. Since England has very little round timber of her own, and since her import of this kind of timber from abroad is not large, the English sawmills are chiefly engaged in resawing into boards of smaller dimensions the larger sizes of imported sawn or hewn timber. The equipment of the sawmills, therefore, is in accordance with these tasks. There are listed 1,219 gang saws (log and deal frames) for logs and thick boards, 8,300 circular saws, 2,134 band saws, 507 horizontal saws, 19 veneer saws, 32 flat veneer knives, 249 circular veneer knives, 3,939 planing and moulding machines, and 3,996 turning lathes and 117 box-nailing machines. Such sawmills are built, as a rule, in large ports where they easily obtain the raw material imported from abroad. From these ports lumber is sold in a semi-manufactured form or is subjected to further manufacture and planing in accordance with the demands of building contractors or of the lumber yards in the interior of the country. The sawmill industry is often combined with the retail selling of lumber. These sawmills are substantially built structures with large, well-ventilated rooms and many devices for rapid disposal of sawdust and shavings.

The Furniture Industry.—The furniture industry is one of the largest of the wood-using industries in the United Kingdom, judging by the gross value of its output, which reaches $88,040,000, and by the fact that 92,106 workers are employed. These figures really do not represent the enormous size of the industry, because in the classification of the wood-using industries many furniture enterprises were classed with the sawmill industry. If other furniture enterprises which were classed with the lumber industry were transferred to this group the gross value of the output would be about $125,000,000, or more than 50 per cent of all the wood-using industries in the United Kingdom. The furniture industry in the United Kingdom is built on a large modern scale, while in Continental Europe, even in Germany, it is mostly centered in small shops employing only a few cabinet makers. In the United Kingdom the annual value of the product of enterprises employing mechanical motive power is $70,000,000, or 79½ per cent of all, while the number of workers is 66,389, or 72 per cent of all in the furniture industry. The aggregate mechanical power used in this industry is 51,192 horsepower.

The Box Industry.—It is natural that in a country like England, which has an enormous export trade, the box industry should be highly developed. The annual product of this industry is approximately $14,653,000 and it employs 12,773 workers. The box industry is even more reduced to mechanical processes than the furniture industry. There are only 867 workers, or 7.3 per cent of all the workers employed in the box industry, who make boxes in small shops without any mechanical appliances. All the rest of the work is done in large factories employing up-to-date machinery and mechanical power, the aggregate of which is 10,203 horsepower.

The Wagon Industry.—The wagon industry is divided, according to English statistics, into horse-drawn vehicles and motor car bodies. The gross value of the products of the wagon industry as a whole is approximately $24,727,000 and it employs 36,362 workers and 10,467 horsepower. Strange as it may seem, although in wagon making a great deal of metal work is involved, the small shop is very prevalent in this industry, employing about half of all the workers in this branch of the industry. This is probably due to the large amount of repair work done in the shops.

The Cooperage Industry.—The cooperage industry is largely a hand industry. It has a gross annual output valued at $5,500,000 and employs 4,939 workers.

The Basket and Wicker Work Industry.—The basket and wicker work industry is also largely a hand industry, because the mechanical devices are still inadequately developed, and because the form of the products is not uniform. The products of the wicker industry represent an annual gross value of $2,078,000 and it employs 3,615 people.

Raw Material.—The wood-using industries of England are based almost entirely on imported raw material. The English statistics show that the annual expenditure for raw materials in the wood-using industries is close to $116,000,000, which is distributed among the six industries as follows:

Industry	Expenditure	Industry	Expenditure
Sawmill	$50,183,348	Wagon	$10,170,985
Furniture	42,353,150	Cooperage	3,309,220
Box	8,954,360	Basket	900,302
		Total	$115,871,365

Even if we deduct from this total some 10 per cent for materials other than wood, the wood-using industries of the United Kingdom represent yearly a market for forest products of about $105,000,000. That this figure is not exaggerated may be gathered from the census of 1907, which shows that the net import of forest products into England for that year was in the neighborhood of $135,000,000. Home-grown timber plays a very insignificant part in supplying this demand. The census brought out that the total amount of home-grown timber used by the wood-using industries during that year was in the neighborhood of 19,100,000 cubic feet, valued at $3,700,000. It is probable, therefore, that no other country in the world offers such a permanent and steady market for forest products as England.

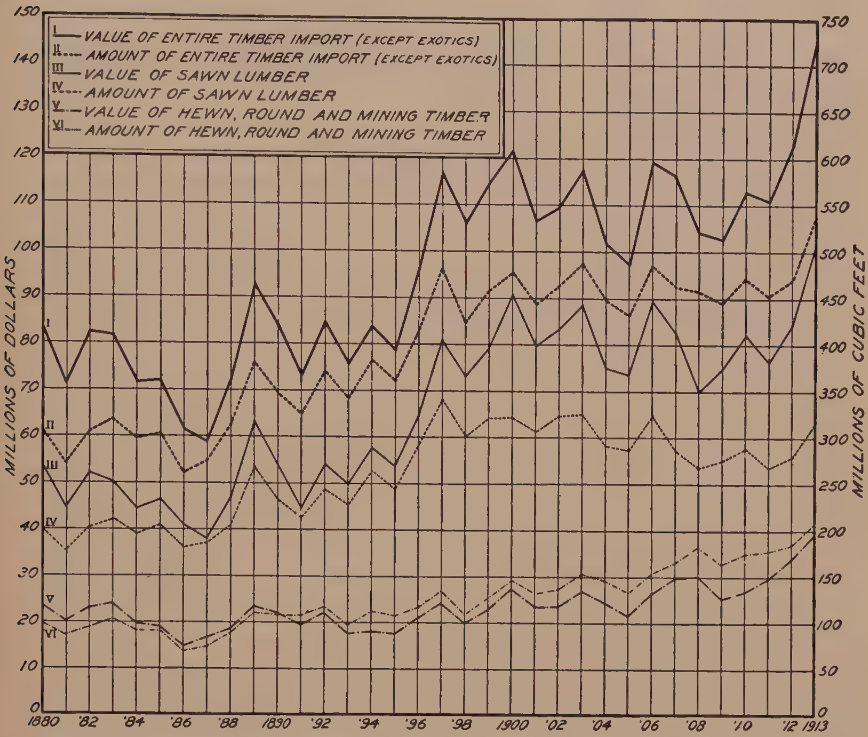

FIG. 4.—Quantities and values of entire timber import (exclusive of tropical or exotic species), and of sawn lumber and hewn, round, and mining timber imported into the United Kingdom (1880–1913).

Foreign Trade in Timber.—The import of timber to the United Kingdom just before the war reached, on the average for the period 1909–1913, an enormous amount, equal in value to about $154,000,000 and in quantity to 657,000,000 cubic feet. (Table 87, p. 162.)

TABLE 88.—TIMBER IMPORTED BY THE UNITED KINGDOM

Kind of timber	In thousands													
	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Pitprops:														
Amt., cu. ft.	(1)	93,991	98,924	116,067	116,629	106,017	122,582	131,360	152,062	131,382	141,029	144,800	146,290	172,566
Value	....	$9,978	$10,181	$12,322	$12,077	$10,871	$13,185	$14,821	$17,396	$14,238	$15,244	$16,408	$17,789	$21,603
Hewn and round timber:														
Conifers:														
Amt., cu. ft.	139,397	30,217	26,209	30,017	25,739	23,787	24,174	28,091	27,395	27,700	27,203	25,331	28,918	26,448
Value	$20,896	$7,685	$6,502	$7,495	$6,222	$6,117	$6,549	$7,267	$6,206	$5,724	$6,074	$6,117	$8,174	$6,797
Oak:														
Amt., cu. ft.	8,690	8,653	9,527	9,580	8,574	7,283	8,632	10,992	10,880	7,827	8,866	9,908	11,295	12,719
Value	$4,951	$4,795	$5,452	$5,756	$5,193	$4,257	$5,199	$6,736	$6,572	$4,673	$5,366	$6,169	$7,320	$8,437
Others:														
Amt., cu. ft.	4,816	3,496	3,476	2,791	2,456	2,692	3,858	2,407	2,101	2,802	2,309	3,680	2,769	4,889
Value	$1,741	$1,333	$1,411	$1,120	$948	$1,097	$1,569	$881	$782	$849	$887	$1,290	$1,137	$1,869
Total:														
Amt., cu. ft.	152,903	42,366	39,212	42,388	36,769	33,762	36,664	41,490	40,376	38,329	38,378	38,919	42,982	44,056
Value	$27,588	$13,813	$13,365	$14,371	$12,363	$11,471	$13,317	$14,884	$13,560	$11,246	$12,327	$13,576	$16,631	$17,103
Sawn timber:														
Conifers:														
Amt., cu. ft.	320,082	304,775	324,058	327,630	293,060	289,896	324,752	290,119	266,033	278,239	291,963	269,132	278,742	322,551
Value	$86,782	$75,892	$79,911	$84,636	$71,550	$70,322	$86,042	$79,256	$67,156	$72,004	$79,238	$73,614	$80,010	$98,080
Other species:														
Amt., cu. ft.	11,554	9,275	9,778	9,482	10,252	9,430	9,861	9,160	8,388	7,856	7,848	9,481	9,719	9,279
Value	$4,034	$3,419	$3,542	$3,780	$3,808	$3,819	$4,038	$4,077	$3,416	$3,179	$3,462	$3,971	$4,272	$4,148
Total:														
Amt., cu. ft.	331,636	314,050	333,836	337,112	303,312	299,326	334,613	299,279	274,421	286,095	299,811	278,613	288,461	331,830
Value	$90,816	$79,311	$83,453	$88,416	$75,358	$74,141	$90,080	$83,333	$70,572	$75,183	$82,700	$77,585	$84,282	$102,228

TABLE 88.—TIMBER IMPORTED BY THE UNITED KINGDOM—*Continued*

Kind of timber	In thousands													
	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Staves:														
Amt., cu. ft.	7,264	7,003	6,000	6,489	6,609	5,959	6,952	8,586	7,351	6,317	8,360	7,985	8,465	9,106
Value	$3,508	$3,550	$3,250	$2,774	$2,565	$2,688	$3,074	$3,579	$3,315	$2,655	$3,373	$3,766	$4,675	$4,861
Tropical timber:														
Teak:														
Amt., cu. ft.	3,154	2,288	2,400	3,416	1,974	3,049	3,089	2,761	1,574	1,693	2,942	2,771	2,548	2,389
Value	$3,820	$2,696	$2,868	$4,313	$2,576	$4,261	$4,657	$4,263	$2,475	$2,625	$4,647	$4,406	$4,169	$4,273
Mahogany:														
Amt., cu. ft.	4,480	3,709	3,095	4,447	5,188	4,827	4,202	5,206	5,974	3,810	4,789	5,236	5,604	7,090
Value	$4,022	$3,117	$2,588	$3,874	$4,339	$3,990	$3,513	$4,341	$4,923	$2,962	$3,820	$4,302	$4,455	$5,958
Other species:														
Amt., cu. ft.	9,607	12,082	11,368	8,786	9,898	9,856	9,759	9,998	9,484	9,835	8,733	8,753	8,644	12,471
Value	$5,722	$6,909	$6,702	$5,747	$5,601	$5,690	$5,860	$6,450	$5,888	$5,747	$5,256	$5,647	$5,814	$8,188
Total:														
Amt., cu. ft.	17,241	18,079	16,863	16,649	17,060	17,732	17,050	17,965	17,032	15,338	16,464	16,760	16,796	21,950
Value	$13,564	$12,722	$12,158	$13,934	$12,516	$13,941	$14,030	$15,054	$13,286	$11,334	$13,723	$14,355	$14,438	$18,419
Grand total:														
Amt., cu. ft.	509,044	475,489	494,835	518,705	480,379	462,796	517,861	498,680	491,242	477,461	504,042	487,077	502,994	579,508
Value	$135,476	$119,374	$122,407	$131,817	$114,879	$113,112	$133,686	$131,671	$118,129	$114,656	$127,367	$125,690	$137,815	$164,214

[1] Before 1901 pitprops were not classified separately.

Note: Some figures in this table do not agree with Tables 89 and 91 on account of discrepancies in original tables.

This represents practically all the classes of wooden goods that may be regarded as essential but leaves out such products as tanning materials and many products which are of exclusively tropical origin.

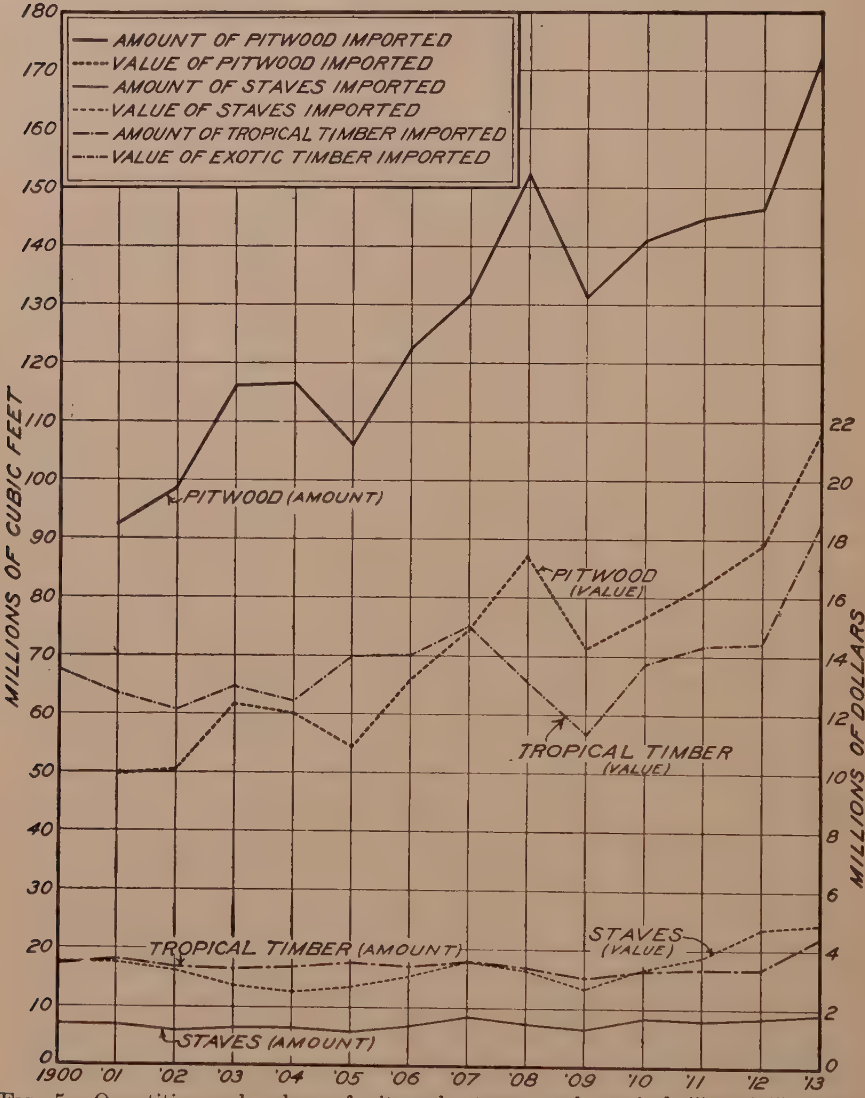

FIG. 5.—Quantities and values of pitwood, staves, and tropical ("exotic") timber imported into the United Kingdom.

In 1919, although the quantity of the imports had decreased, their value rose to about $351,500,000, an increase of 114 per cent. Of all the important countries of the world, England until lately occupied the first place as to the amount of timber imported and only in the late years before the war Germany began to rival her in the amount of timber importations. Germany in 1913 increased her timber import to 584,342,000 cubic feet, valued at $93,624,000. The value of the timber imported into the United Kingdom formed for the year 1911 2.7 per cent of the value of the entire import into the country. The imports of wood and timber by the United Kingdom stand fourth in order in the value of her imports of raw material, cotton, wool, and the group classified under the heading of oil seeds, nuts, etc., alone exceeding them. In Table 88 and Figs. 4 and 5 are given the imports of pitwood, hewn and round timber, sawn timber, staves, and tropical woods for the period from 1900 to 1913. The different kinds of timber participated in the total import in the following proportions:

Kind of timber	In quantity	In value
	per cent	*per cent*
Sawn timber	61.4	64.4
Pitwood	25.7	11.2
Hewn and round timber	7.9	10.7
Tropical timber	3.6	11.1
Staves	1.4	2.6

As may be seen from the curves in Fig. 4, there was a general increase in imports from 1880 to 1897, and from that time on until 1912 the fluctuations compensated each other, the imports remaining stationary at an average level of about 475 million cubic feet. In 1913 there was a pronounced increase in total imports, but that year still remains without connection with the subsequent period and therefore can not be accepted as the beginning of a new period of increased demand. Since during that year there was an almost general increase in imports of all kinds of timber, however, it seems that this increase is not accidental, but may mark a new period of increased consumption in the United Kingdom. For the 30-year period from 1880 to 1919 the import of wood and timber into the United Kingdom increased from an average level of 300 million cubic feet to 450–475 million cubic feet, or 50 per cent. The value of the import for the same period increased from $77,864,000 to $111,929,500, or 44 per cent.

Sawn Timber.—The sawn timber forms the largest item of English import, amounting to 300,000,000 cubic feet and having a value of $82,730,500. In the import of sawn lumber conifers predominate, making up 97.1 per cent in quantity and 95.5 per cent in value. Sawn lumber includes boards, flooring, strips and plaster lath, moulding, weather boards, and similar material. Hardwood sawn lumber forms but a small percentage (2.9 in quantity and 4.5 in value) of all the imported lumber.

It is made up chiefly of oak and birch boards and occasionally of alder, ash, aspen, and several other species. The amount and value of imported sawn lumber have followed in general the course of the total timber import. This is only natural, as sawn lumber forms the bulk of all the imports. The value of imported sawn lumber at first followed the quantity closely, but after 1897 the value increased much faster than the quantity, which would indicate not only an increase in the amount of imported sawn lumber but also an increase in the price.

Pitwood.—The next important item of the English timber import is pitwood. The pitwood, however, is not all used for mine props; some of it is sawn for box material and even into veneer. Under the name of pitwood is also included small round timber used for the manufacture of wood pulp. The pitwood forms 25.7 per cent in quantity and 11.2 per cent in value of all the timber imports. The import of pitwood has grown uninterruptedly, as can be gathered from the following figures:

Years	Average quantity	Average value
	cu. ft.	
1901–1905..........	106,326,400	$11,101,207
1906–1910..........	135,673,850	14,995,108
1911–1913..........	154,552,400	18,624,971

In the import of pitwood there may be clearly noticed two sharp falls, one in 1905 and the other in 1909 (Fig. 4). These years coincide with the years of the Russian-Japanese war and a series of strikes in Sweden, and Russia and Sweden supplied most of this kind of timber. Pitwood does not represent a uniform grade of timber. The dimensions depend upon the purpose for which and place where they are to be used. The largest coal mines in England are in the region of the Bristol Channel with its center at Cardiff, in the west, the region of New Castle in the east, and Scotland in the north. Because of the difference in the geological and hydrological conditions of the mines, the size of the galleries, etc., the sizes of the mine props used in different mining regions are also different. The Bristol region secures most of its mining timber from the Landes of France, and the other regions from northeastern Europe.

Hewn and Round Timber.—Under hewn and round timber are usually grouped different kinds of timber, railroad ties, round logs, and so on, and until 1901 in this group were included also small round pit props. The importation of this class of timber also shows an uninterrupted growth. Since, however, it included so many different kinds of timber—from large-sized timber to small round timber—it was very difficult to determine just what kind predominated. Only since English statistics began to separate pit props from other hewn and round timber has it become evident that the growth must have been chiefly because of the growing demand for pit props. Among the large-sized hewn timber, oak, imported largely from the United States, plays an important part.

Staves.—The import of staves into England on the whole is not very great. On the average for the period from 1900-13 there were imported annually 7,318,300 cubic feet valued at $3,406,803. Evidently the demand for staves has reached a stationary level and the increase is very slow. A slight increase in the value of staves may be largely accounted for by an increase in the price of oak staves, which form the bulk of the stave import.

Tropical Timber.—The import of teak, mahogany, and other tropical timber did not show great increases and the values have fluctuated only within narrow limits.

The Share of Different Countries in Supplying the Timber Needs of the United Kingdom.—Table 89 shows import of sawn, hewn, and round timber from her colonies and foreign countries into the United Kingdom. It reveals the significant fact that the English colonies con-

TABLE 89.—IMPORT OF SAWN, HEWN, AND ROUND TIMBER INTO THE UNITED KINGDOM FROM COLONIES AND FOREIGN COUNTRIES

Years	From colonies		From foreign countries		
	Sawn	Hewn and round	Sawn	Hewn and round	Total
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
1903.........	75,376,500	3,327,950	261,678,850	158,547,800	498,931,100
1904.........	64,029,900	2,589,900	239,278,200	152,807,000	458,705,000
1905.........	58,008,450	3,024,050	241,280,800	139,934,750	442,248,050
1906.........	71,255,600	3,676,950	263,357,400	158,712,350	497,002,300
1907.........	56,427,200	2,254,300	242,843,950	173,394,900	474,920,350
1908.........	50,017,800	1,983,000	224,404,550	192,183,250	468,588,600
1909.........	52,505,300	1,702,250	233,598,750	169,705,800	457,512,100
1910.........	55,277,250	1,657,350	244,404,200	180,689,350	482,028,150
1911.........	49,908,350	1,968,400	228,704,650	184,532,500	465,113,900
1912.........	44,774,800	2,655,450	243,604,650	189,171,150	480,206,050
Average.	57,758,115	2,483,960	242,315,600	169,967,885	472,525,560
Per cent..	12.2	0.5	51.3	36.0	100

Note: Some figures in this table do not agree with Tables 88 and 91 because of discrepancies in the original tables.

tribute only 12.7 per cent toward supplying the market of the United Kingdom while foreign countries supply 87.2 per cent. Another important fact is that for the last decade the import from colonies has decreased both absolutely and relatively. Thus during the first five years of the decade before 1913 the average import from colonies was 68,000,000 cubic feet, or 13.6 per cent of the entire import for 1903. During the second five years this import fell to 52,489,990 cubic feet, a decrease of 22.8 per cent, and formed only 9.8 per cent of the entire import for that period.

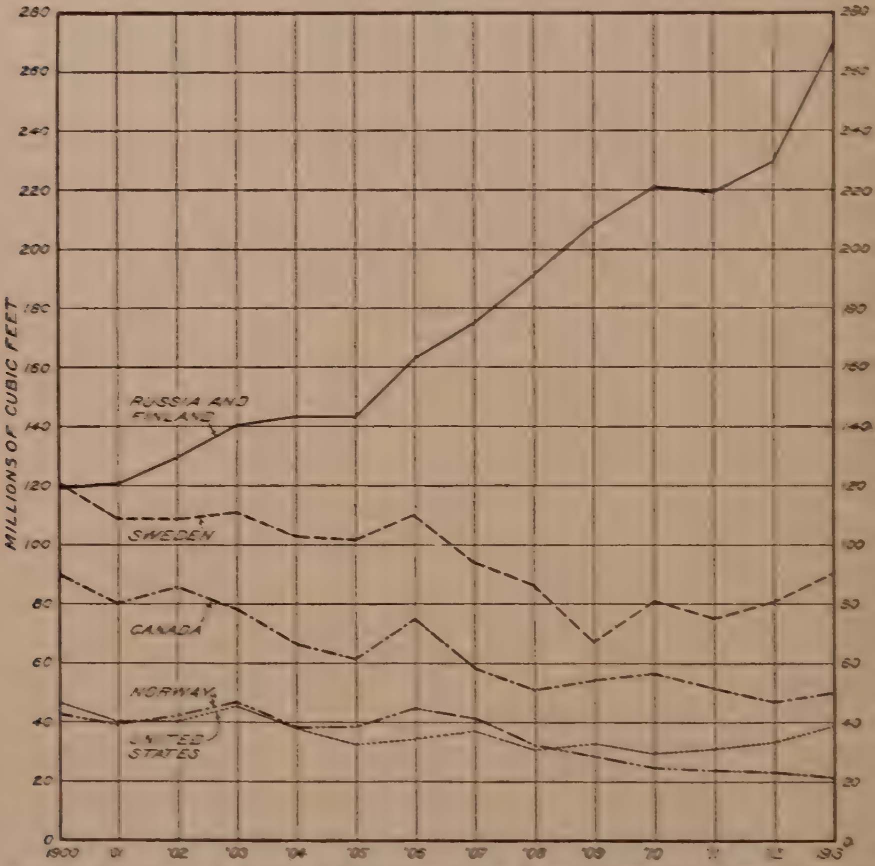

Fig. 6.—Quantities of wood and timber (exclusive of tropical woods) imported into the United Kingdom, 1900–1913.

This is true not only of the quantity but also of the value of the imported timber. While in 1900 the value of the timber imported from colonies formed 24.9 per cent and from foreign countries 75.1 per cent, in 1911 the value of timber imported from colonies was only 17.9 per cent and that from foreign countries 82.1 per cent. This decrease is due chiefly to the decrease in the import from Canada. The countries which chiefly supply the timber market of the United Kingdom are Russia, Finland, Sweden, Norway, the United States, and Canada.

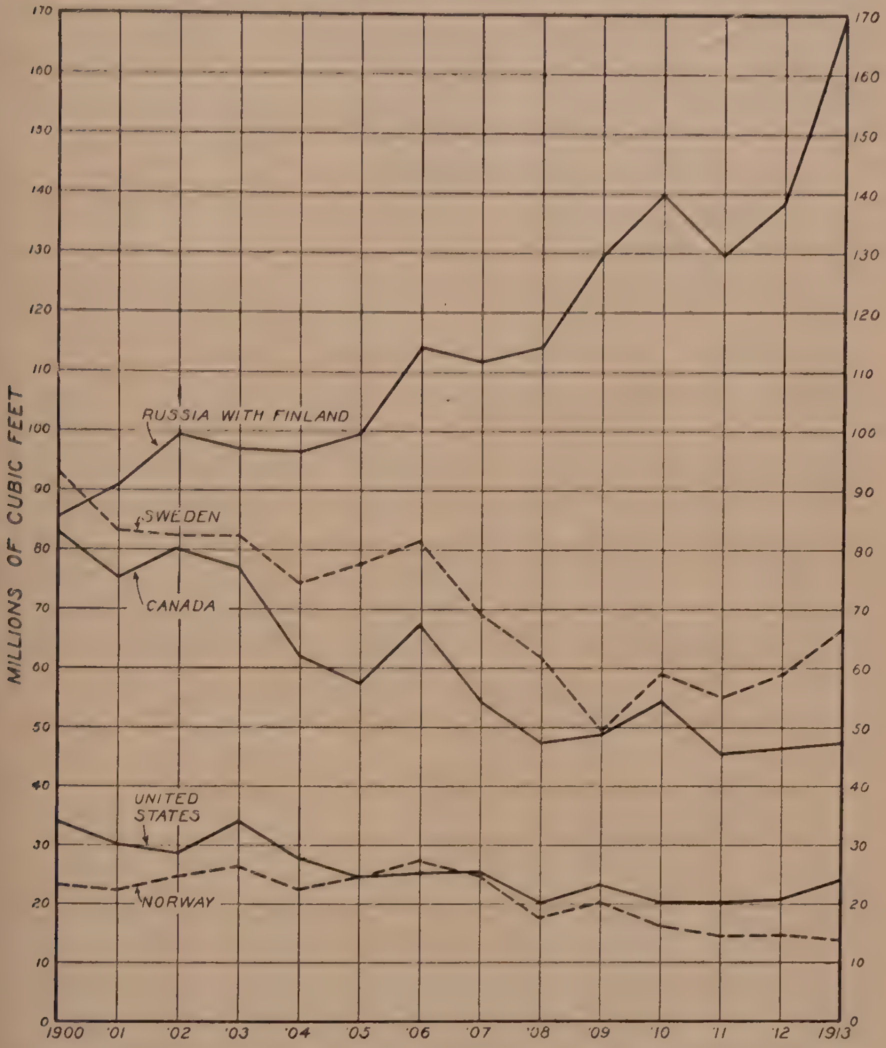

FIG. 7.—Quantities of sawn lumber imported into the United Kingdom from different countries.

Tables 90 and 91 and Figs. 6 and 7 show the import of timber into the United Kingdom from different countries, irrespective of kind and also by kinds of product.

In 1900 Russia furnished almost one-fourth of all the timber products, namely, 26.0 per cent of all sawn timber, 19.9 per cent of hewn and round timber, and 32.6 per cent of staves. For the 14 years from 1900 to 1913 the import from Russia increased in quantity 127 per cent and in value 120 per cent, and was nearly half of the total import in 1913.

Particular increase is noted in the imports of pitwood. From

TABLE 90.—QUANTITY AND VALUE OF WOOD AND TIMBER (EXCLUSIVE OF TROPICAL WOODS) IMPORTED INTO THE UNITED KINGDOM FROM DIFFERENT COUNTRIES

Period 1900-1913

Year	Russia—including Finland				Sweden				Norway				United States				Canada				Other countries				Total	
	Quantity		Value		Quantity		Value		Quantity		Value		Quantity		Value		Quantity		Value		Quantity		Value		Quantity—M cu. ft.	Value—thousands
	M cu. ft.	Per cent	Thousands	Per cent	M cu. ft.	Per cent	Thousands	Per cent	M cu. ft.	Per cent	Thousands	Per cent	M cu. ft.	Per cent	Thousands	Per cent	M cu. ft.	Per cent	Thousands	Per cent	M cu. ft.	Per cent	Thousands	Per cent		
1900..	118,974	24.2	$30,188	24.7	121,118	24.8	$27,827	22.8	43,322	8.8	$9,771	8.0	47,340	9.6	$17,369	14.2	90,303	18.4	$25,595	20.9	70,746	14.4	$11,326	9.3	491,803	$122,076
1901..	120,322	26.3	27,219	25.6	109,626	24.0	23,146	21.7	39,754	8.7	8,921	8.3	40,864	8.9	14,641	13.7	80,536	17.6	22,130	20.7	66,307	14.5	10,738	10.0	457,409	106,795
1902..	129,721	27.1	29,892	27.1	109,236	22.8	22,209	20.1	42,390	8.9	8,876	8.0	40,329	8.4	14,789	13.8	86,019	18.0	23,622	21.3	70,278	14.7	11,008	10.0	477,973	110,396
1903..	140,206	27.9	31,899	27.0	110,506	22.0	23,400	19.8	47,135	9.4	10,397	8.8	45,863	9.1	17,025	14.4	78,829	15.7	22,980	19.5	79,515	15.8	12,340	10.4	502,054	118,041
1904..	143,245	30.9	30,519	29.8	103,822	22.4	20,372	19.9	38,763	8.4	8,712	8.5	38,594	8.3	14,436	14.1	66,716	14.4	18,542	18.1	72,178	15.6	9,921	9.7	463,318	102,502
1905..	143,347	32.2	30,664	30.9	102,026	22.9	20,369	20.5	38,869	8.7	8,240	8.3	32,734	7.3	12,370	12.4	61,570	13.8	17,990	18.0	66,518	14.9	9,671	9.7	445,064	99,304
1906..	163,336	32.6	37,397	31.2	110,031	22.0	23,678	19.8	44,958	9.0	10,264	8.6	35,052	7.0	15,004	12.5	75,281	15.0	22,918	19.2	72,152	14.4	10,555	8.8	500,810	119,816
1907..	174,502	36.5	40,139	34.4	94,446	19.8	21,132	18.1	41,799	8.7	10,208	8.7	37,570	7.9	16,687	14.3	58,602	12.3	17,922	15.3	70,796	14.8	10,686	9.1	477,715	116,774
1908..	195,319	41.2	39,154	37.3	86,010	18.1	18,175	17.3	32,561	6.9	7,743	7.4	31,472	6.6	14,234	13.5	51,719	10.9	15,485	14.8	77,131	16.3	10,191	9.7	474,212	104,982
1909..	208,606	45.1	43,234	41.8	67,771	14.7	14,608	14.1	28,380	6.2	7,371	7.1	33,451	7.2	13,424	13.0	54,250	11.7	16,106	15.6	69,664	15.1	8,716	8.4	462,122	103,459
1910..	220,185	45.2	48,318	42.5	80,981	16.6	18,752	16.5	24,973	5.1	7,057	6.2	30,006	6.2	13,152	11.5	56,983	11.7	17,046	14.9	74,451	15.3	9,471	8.3	487,579	113,796
1911..	218,994	46.6	48,498	43.5	74,992	15.9	16,991	15.2	24,298	5.2	6,478	5.8	31,617	6.7	13,975	12.5	51,953	11.0	16,091	14.4	68,463	14.5	9,450	8.5	470,317	111,483
1912..	229,577	47.2	54,539	44.1	80,620	16.6	19,135	15.5	23,474	4.8	6,494	5.2	33,563	6.9	16,786	13.6	47,478	9.8	16,475	13.3	71,485	14.7	10,114	8.2	486,197	123,543
1913..	269,604	48.4	66,293	45.4	90,443	16.2	22,371	15.3	21,618	3.9	6,779	4.6	39,365	7.0	20,126	13.8	50,101	8.9	17,982	12.3	86,429	15.5	12,439	8.5	557,560	145,990

TABLE 91.—QUANTITY AND VALUE OF WOOD AND TIMBER IMPORTED BY THE UNITED KINGDOM—BY KINDS AND COUNTRIES

Sources of imports by kinds	1900		1901		1902		1903		1904		1905		1906	
	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands
Pitwood:														
Russia	....	....	13,110	$ 1,667	13,959	$ 1,656	24,879	$ 3,160	28,540	$ 3,573	23,863	$ 2,923	31,753	$ 3,960
Sweden	....	....	23,247	3,123	23,380	3,000	23,826	3,161	25,399	3,287	21,931	2,793	24,265	3,163
Norway	....	....	12,327	1,632	12,828	1,550	14,572	1,908	9,761	1,264	10,213	1,253	12,331	1,624
France	....	....	34,260	2,581	33,372	2,606	34,174	2,592	34,698	2,524	35,856	2,741	37,165	2,995
Portugal	....	....	7,425	592	11,165	922	14,310	1,053	13,753	987	9,244	697	13,240	1,070
Other countries	....	....	3,522	383	4,220	447	4,306	448	4,478	442	4,910	464	3,828	373
Total	....	....	93,991	$ 9,978	98,924	$10,181	116,067	$12,322	116,629	$12,077	106,017	$10,871	122,582	$13,185
Hewn and round timber:														
Russia	30,367	$ 5,534	13,534	$ 3,092	11,389	$ 2,667	14,583	$ 3,161	13,939	$ 3,231	12,535	$ 2,878	13,348	$ 3,373
Sweden	27,091	3,924	1,427	234	1,536	250	1,777	310	1,683	290	995	170	1,427	274
Norway	17,373	2,672	2,739	509	2,982	522	3,234	571	2,800	509	2,658	473	2,427	447
Germany	13,638	3,518	11,315	3,130	9,452	2,569	9,252	2,665	6,326	1,851	6,432	1,911	7,365	2,121
United States	9,033	4,270	8,165	3,887	9,037	4,481	9,600	4,977	8,626	4,440	7,411	3,576	8,333	4,247
Canada	5,674	2,935	4,437	2,410	3,944	2,238	3,328	2,157	2,590	1,443	2,983	1,848	3,667	2,338
Other countries	49,727	4,735	749	551	1,373	638	614	530	805	599	748	615	97	517
Total	152,903	$27,588	42,366	$13,813	39,713	$13,365	42,388	$14,371	36,769	$12,363	33,762	$11,471	36,664	$13,317
Sawn lumber:														
Russia	86,237	$23,594	91,412	$21,501	102,492	$24,568	98,215	$24,654	98,177	$22,809	104,789	$23,888	115,746	$28,993
Sweden	93,347	23,687	84,268	19,613	84,019	18,871	84,184	19,744	75,778	16,532	78,200	17,178	82,652	19,725
Norway	24,621	6,728	23,427	6,390	25,206	6,408	27,980	7,536	24,697	6,520	24,843	6,182	29,212	7,908
United States	36,469	12,069	30,871	9,658	29,674	9,230	35,013	11,218	29,035	9,369	24,231	8,081	25,355	9,804
Canada	84,402	22,539	75,861	19,582	81,983	21,312	75,408	20,747	64,030	16,998	58,481	16,073	71,515	20,503
Other countries	6,560	2,199	8,211	2,567	10,462	3,064	16,312	4,517	11,595	3,130	8,782	2,739	10,133	3,147
Total	331,636	$90,816	314,050	$79,311	333,836	$83,453	337,112	$88,416	303,312	$75,358	299,326	$74,141	334,613	$90,080
Staves:														
Russia	2,369	$ 1,021	2,267	$ 922	1,880	961	2,529	$ 880	2,588	$ 864	2,160	$ 933	2,490	$ 1,021
Sweden	680	178	583	145	302	59	719	153	962	236	900	201	1,686	484
Norway	1,329	358	1,262	378	1,376	384	1,349	369	1,505	408	1,155	320	988	272
Germany	717	782	747	857	671	701	468	470	296	294	419	426	279	289
United States	1,838	1,007	1,828	1,077	1,618	1,059	1,251	808	934	607	1,091	697	1,364	932
Canada	227	86	238	108	91	40	93	46	228	80	107	46	99	46
Other countries	104	76	78	63	62	44	80	48	96	76	127	65	46	30
Total	7,264	$ 3,508	7,003	$ 3,550	6,000	$ 3,248[1]	6,489	$ 2,774	6,609	$ 2,565	5,959	$ 2,688	6,952	$ 3,074
Timber of tropical species	17,241	$13,564	18,079	$12,722	16,863	$12,158	16,649	$13,934	17,060	$12,516	17,732	$13,941	17,050	$14,030

[1] Does not agree with Tables 88 and 89 on account of discrepancies in original tables.

TABLE 91.—QUANTITY AND VALUE OF WOOD AND TIMBER IMPORTED BY THE UNITED KINGDOM—BY KINDS AND COUNTRIES—(*Cont'd.*)

Source of imports by kinds	1907		1908		1909		1910		1911		1912		1913	
	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands	Quantity—M cu. ft.	Value—thousands
Pitwood:														
Russia	41,148	$ 5,342	59,016	$ 7,893	53,877	$ 6,935	57,328	$ 7,284	64,284	$ 8,404	63,826	$ 9,334	76,936	$11,737
Sweden	21,462	2,896	20,458	2,893	13,372	1,813	17,226	2,295	16,801	2,295	16,117	2,329	17,999	2,712
Norway	11,851	1,693	11,096	1,611	6,125	880	5,996	842	6,531	925	5,567	872	5,739	977
France	40,879	3,441	43,784	3,491	36,298	2,869	38,793	3,067	38,811	3,207	41,922	3,499	49,216	4,078
Portugal	12,186	1,061	13,922	1,110	17,265	1,355	16,398	1,324	14,267	1,186	13,560	1,193	15,777	1,352
Other countries	3,834	388	4,286	398	4,445	386	4,788	432	4,106	391	5,298	562	6,899	747
Total	131,360	$14,821	152,562	$17,396	131,382	$14,238	141,029	$15,244	144,800	$16,408	146,290	$17,789	172,566	$21,603
Hewn and round timber:														
Russia	17,465	$ 4,443	18,477	$ 3,736	21,010	$ 3,687	18,982	$ 3,805	18,790	$ 4,032	21,306	$ 5,373	19,895	$ 4,659
Sweden	1,052	199	1,213	226	1,277	219	828	172	1,505	282	1,631	342	1,894	411
Norway	2,414	444	1,850	370	1,486	309	1,492	303	1,535	302	1,614	358	1,475	370
Germany	8,621	2,471	6,587	1,978	4,730	1,344	6,625	1,906	4,746	1,519	5,077	1,869	5,312	2,139
United States	9,072	4,893	9,495	5,181	7,584	3,839	8,227	4,394	9,546	5,058	9,939	5,591	12,301	6,934
Canada	2,233	1,705	1,931	1,397	1,702	1,230	1,657	1,259	1,968	1,692	2,655	2,294	1,983	1,511
Other countries	633	729	823	672	540	618	567	488	829	691	760	804	1,196	1,079
Total	41,490	$14,884	40,376	$13,560	38,329	$11,246	38,378	$12,327	38,919	$13,576	42,982	$16,631	44,056	$17,103
Sawn timber:														
Russia	112,559	$28,958	115,249	$26,347	130,604	$31,442	140,073	$35,753	132,328	$34,381	140,738	$37,718	168,167	$47,471
Sweden	70,376	17,549	62,503	14,487	52,152	12,314	60,867	15,716	55,068	13,964	61,077	15,920	68,523	18,633
Norway	25,378	7,391	18,799	5,380	19,863	5,933	16,475	5,358	15,434	5,006	15,530	5,006	14,731	5,198
United States	27,408	11,017	20,757	8,125	24,903	8,876	20,640	7,909	20,620	7,967	21,846	9,850	25,530	11,871
Canada	56,241	16,129	49,696	14,019	52,505	14,829	55,280	15,735	49,908	14,336	44,775	14,131	48,077	16,423
Other countries	7,317	2,289	7,417	2,214	6,068	1,789	6,476	2,229	5,255	1,931	4,495	1,657	6,802	2,632
Total	299,279	$83,333	274,421	$70,572	286,095	$75,183	299,811	$82,700	278,613	$77,585	288,461	$84,282	331,830	$102,228
Staves:														
Russia	3,329	$ 1,343	2,577	$ 1,125	3,115	$ 1,112	3,802	$ 1,411	3,592	$ 1,616	3,708	$ 2,041	4,605	$ 2,337
Sweden	1,556	461	1,835	545	971	243	2,060	544	1,619	427	1,796	518	2,026	584
Norway	2,156	666	1,316	372	906	239	1,010	288	798	236	762	249	673	226
Germany	273	255	274	284	291	321	232	231	382	467	244	402	159	316
United States	1,090	754	1,220	909	964	691	1,138	831	1,450	931	1,779	1,322	1,534	1,295
Canada	128	63	91	49	42	26	46	30	77	43	47	28	41	23
Other countries	54	37	38	31	28	23	72	38	67	46	129	115	68	80
Total	8,586	$ 3,579	7,351	$ 3,315	6,317	$ 2,655	8,360	$ 3,373	7,985	$ 3,766	8,465	$ 4,675	9,106	$ 4,861
Timber of tropical species	17,965	$15,054	17,032	$13,286	15,338	$11,334	16,464	$13,723	16,760	$14,355	16,796	$14,438	21,950	$18,419

Note: Some figures in this table do not agree with Tables 88 and 89 on account of discrepancies in original tables.

1901–13 it increased in quantity from 13,110,000 cubic feet to 76,936,000 cubic feet, and in value from $1,667,000 to $11,737,000. The chief importance, however, of the Russian import lies in sawn timber. This in 1913 amounted to 168,167,000 cubic feet, valued at $47,471,000. In other words, the import of sawn timber almost doubled. Since the total import into the United Kingdom for the same period increased but little, it is evident that the import from Russia increased at the expense of that from other countries. Sweden, which dominated the English market in 1900, by 1913 had decreased its export to England by 25 per cent in quantity and 20 per cent in value, Norway by 50 per cent in quantity and 30 per cent in value, and Canada by 44 per cent in quantity and 29 per cent in value. The decrease in the import from the United States is not so conspicuous, since years of increase and decrease alternated, yet there is apparent a net decrease in quantity of 17 per cent.

The different exporting countries just before the war participated in supplying the needs of the United Kingdom in the following order:

Country	By quantity of import	Country	By value of import
	per cent		*per cent*
Russia	48.4	Russia	45.4
Sweden	16.2	Sweden	15.3
Canada	8.9	United States	13.8
United States	7.0	Canada	12.3
Norway	3.9	Norway	4.6

It is of interest to compare the share which the different countries have in supplying particular kinds of timber.

Pitwood.—The participation of the different countries in supplying pitwood to the United Kingdom on an average for the five years, 1909–13, is shown in Table 92.

TABLE 92.—ANNUAL IMPORT OF PITWOOD INTO THE UNITED KINGDOM

Country	Cu. ft.	Per cent	Value	Per cent
Russia	63,250,100	42.9	$8,750,741	51.2
Sweden	16,303,000	11.1	2,292,078	13.4
Norway	5,991,850	4.1	900,487	5.3
France	41,008,100	27.8	3,348,381	19.6
Portugal	15,553,300	10.6	1,283,408	7.5
Other countries	5,107,100	3.5	504,374	3.0
Total	147,213,450	100.0	$17,079,469	100.0

Russia thus furnishes the largest part of the import of pitwood. It is followed by France, which exports chiefly a product of small value obtained from thinnings in the pine forests of the Landes. These thinnings are confined to trees tapped to exhaustion for resin. "Pitwood," as classified by the English customs officers, includes also spruce timber for the manufacture of mechanical wood pulp and cellulose. Since the more valuable grades of this group are obtained from the lower part of the trees and therefore from young stands which would be more valuable if allowed to grow to large sizes, some countries discourage their export by various export tariffs, or even entirely prohibit it as, for instance, the Province of Ontario, Canada. Russia, France, and Portugal developed the export of pitwood to large proportions, that of Russia having increased almost six times in the 14 years prior to 1914. Norway and Sweden, on the other hand, have diminished their export, although not to a very large extent. Canada and the United States do not figure at all in the British import of pitwood, first because of the unprofitableness of transport from a distance of such poor material, and secondly because of the legislative limitation of such export by Canada, which has a well-developed mining and pulp industry.

The consumption of pitwood in the United Kingdom during the 5 years from 1909–13 was about 187,500,000 cubic feet per annum. In 1913 it was roughly 212,500,000 cubic feet. Home-grown timber constituted about 37,500,000 cubic feet. As no pitwood was imported from other parts of the British Empire, the United Kingdom is thus dependent on foreign countries for at least 80 per cent of its supply. When during the war it became evident that the supply of pitwood, particularly from the Baltic region, would be curtailed, the British Government made inquiries to ascertain whether some part of the deficit could not be made up by obtaining supplies from Newfoundland and Canada. The representative of the Board of Trade, after making an investigation on the ground, reported that there is an almost inexhaustible quantity of timber in certain parts of Newfoundland and the maritime provinces of eastern Canada. It was estimated that the quantity of pitwood available from Canada and Newfoundland in 1915 would be:

From	*Cords*
Newfoundland	37,500
Cape Breton	5,350
Nova Scotia	50,000
Quebec	124,000
Ontario	170,000

a total of 386,850 cords, or 47,500,000 cubic feet.

As regards future supplies, it has been estimated that Newfoundland could eventually supply annually at least 300,000 cords, or 37,500,000 cubic feet, and Canada probably much more. The real problem, however, as to quantities procurable from other parts of the British Empire resolves itself into a question of cost of transportation. Whether this factor can ever be overcome sufficiently to make the United Kingdom independent to a large extent of foreign countries is problematic. Even in 1915, when pit props were vital for maintaining the operation of the mines, the import of pitwood from Empire sources fell far short of the amount estimated to be available. It was not quite 5 million cubic feet, and of this 4,300,000 came from Newfoundland and probably only 700,000 cubic feet from Canada. It would seem, therefore, that by force of economic conditions northeastern Europe will continue to be the chief source of pitwood supply in the United Kingdom. The scarcity of pitwood has stimulated the use of home-grown timber as well as the use of steel and concrete props, especially in main roads and airways under ground. It is likely that the United Kingdom can become less dependent for pitwood on foreign importation rather by growing its own pit props at home than by relying upon importations from Canada or other distant parts of the Empire. In countries like France, Sweden, and Norway, as a rule, the mine props are the product of thinnings, while in Canada and the United States where no thinnings are made in the forest they have to come from the valuable main stand.

Hewn and Round Timber.—In the importation of hewn and round timber the different countries participated during the five years (1909–13) before the war, as shown in Table 93.

TABLE 93.—ANNUAL IMPORTS OF HEWN TIMBER

Country	Cu. ft.	Per cent	Value	Per cent
Russia	19,996,450	49.3	$4,316,839	30.4
Sweden	1,426,750	3.5	285,474	2.0
Norway	1,520,350	3.8	328,805	2.3
Germany	5,297,800	13.1	1,757,955	12.4
United States	9,519,600	23.5	5,170,165	36.4
Canada	1,993,250	4.9	1,599,453	11.3
Other countries	778,500	1.9	736,973	5.2
	40,532,700	100.0	14,195,664	100.0

In this group Russia again occupies first place at least in quantity, but yields to the United States in the value of the import. The United States exports chiefly valuable longleaf pine of large dimensions. An important position in the import of hewn and round timber before the war was occupied by Germany (13 per cent by quantity and 12.4 per cent by value). This is particularly remarkable since Germany herself was an importing country. It may be explained only by the fact that Germany acted as an intermediary, buying Russian timber and reselling it to England through its Baltic ports. Germany acted in a similar capacity in selling oak timber to England. As compared with the five years, 1901–5, the import from Germany of hewn and round timber has decreased on the average by 38 per cent in quantity and 27.6 per cent in value. Russia, on the other hand, has increased its export from 13,196,150 cubic feet to 19,996,450 cubic feet, or 52 per cent, and in value from $3,009,882 to $4,316,839, or 43 per cent. The United States showed also an increase from 8,567,850 to 9,519,600 cubic feet, or 11 per cent, and in value from $4,828,843 to $5,170,165, or 17 per cent.

Hewn and Round Oak Timber.—Since oak forms in value nearly half of all the hewn and round timber imported by England, it is registered separately. The part which different countries played in supplying this material during the five-year period between 1909–13 is shown in Table 94.

Table 94.—Annual Imports of Hewn and Sawn Oak Timber from Different Countries

Country	Cu. ft.	Per cent	Value	Per cent
United States	7,315,450	72.3	$4,223,820	66.0
Russia	1,064,600	10.5	793,614	12.4
Germany	771,600	7.6	421,371	6.6
Canada	389,950	3.9	317,364	4.9
Austria-Hungary	297,900	2.9	485,253	7.6
Japan	233,650	2.3	132,928	2.1
Other countries	50,250	0.5	26,449	0.4
Total	10,123,400	100.0	6,400,799	100.0

The United States was thus far ahead of other countries in the import of oak into the United Kingdom. European countries have exhausted their oak forests, especially Austria-Hungary, which not long ago was the chief exporter of oak into western European markets. Its place has now been taken by the United States.

The share of Russia in supplying the market of the United Kingdom with oak timber was really larger than the figures indicate, since the oak timber exported by Germany to the United Kingdom was actually Russian timber. Russia, however, like most other European countries, does not possess large supplies of oak timber and therefore her export of this species is bound to develop very slowly.

Sawn Lumber.—The best indication of the competition of the different countries for the British market is their share in supplying sawn timber. Each country naturally aims to export sawn timber in preference to round timber. In 1900 Russia, Sweden, and Canada were almost equal rivals in supplying sawn lumber. Since then, however, the race has become uneven. While Russia by 1913 had increased her export of sawn lumber by 101.2 per cent in value and by 95 per cent in quantity, Sweden and Canada had lost, the former 26.5 per cent in quantity and 21.3 in value, and the latter 43 per cent in quantity and 27.1 per cent in value. The United States and Norway had similarly lost comparatively little in value, especially the United States, which compensated her loss by an increased export for the last two years—1912–13. British statistics separate the imported sawn lumber into only two groups: softwoods (conifers) and not enumerated (largely broadleaf). The softwood sawn lumber greatly exceeds the hardwood lumber. Thus during the five-year period, 1909–13, there was imported on the average 95.5 per cent softwood lumber and only 4.5 per cent hardwood lumber. Exporters of sawn hardwood lumber were chiefly Canada, the United States, Russia, France, and Holland. The latter is evidently merely an intermediary in selling this kind of timber. The first place in import of hardwood sawn lumber is occupied by Canada (36.2 per cent), but Canada exports less valuable species, for instance birch, and therefore it is exceeded in value by imports from the United States. All other countries export comparatively small amounts of this kind of timber to Great Britain.

Staves.—The import of staves into the United Kingdom on the whole is not great. Even during the last three years before the war when this import somewhat increased, its total value still formed but 3.5 per cent of the total value of imported timber. British statistics do not separate the imported staves by species, yet this is very important in analyzing the import of this commodity It makes a great difference whether the imported staves are oak staves or softwood staves. Oak staves bring very high prices, while sawn staves of conifers bring prices even lower than sawn softwood timber. This explains why in Table 95 Sweden and Norway, which export considerable quantities of staves to the United Kingdom, still occupy the last place as to the value of the exported material. The chief exporters of staves as regards value are the United States and Russia. Both of these countries export almost entirely oak staves. Russia has perceptibly increased its export and during the last three years before the war brought it up to 46.6 per cent in quantity and 45 per cent in value. The United States has also increased its export absolutely but not relatively. Germany has lost its importance in stave trade both absolutely and relatively.

TABLE 95.—ANNUAL IMPORT OF STAVES INTO THE UNITED KINGDOM FROM DIFFERENT COUNTRIES

Country	1901–1905	Per cent	1906–1910	Per cent	1911–1913	Per cent
Russia:						
Cu. ft.	2,250,000	35.4	2,950,000	39.6	3,950,000	46.6
Value	$900,000	30.3	$1,119,000	35.0	$2,000,000	45.0
Germany:						
Cu. ft.	550,000	8.3	350,000	4.7	250,000	3.1
Value	$565,000	9.0	$360,000	11.2	$394,000	8.9
Sweden:						
Cu. ft.	650,000	10.6	1,450,000	19.3	1,800,000	21.3
Value	$156,000	5.2	$399,000	12.5	$511,000	11.5
Norway:						
Cu. ft.	1,350,000	21.0	1,450,000	19.2	750,000	8.7
Value	$375,000	12.6	$423,000	13.2	$238,000	5.4
United States:						
Cu. ft.	1,350,000	21.0	1,150,000	15.4	1,600,000	18.6
Value	$852,000	28.7	$827,000	25.8	$1,183,000	26.6

Tropical Timber.—Of the timber imported into the United Kingdom, teak and mahogany are of particular interest, since these species serve not only for the needs of the United Kingdom but also are objects of trade with other countries.

Teak.—The average import of teak into the United Kingdom for the period 1900–13 is shown in Table 96.

TABLE 96.—IMPORTS OF TEAK

Source	1900–1904	Per cent	1905–1909	Per cent	1910–1913	Per cent
From foreign countries:						
Tons	8,206	15.5	17,526	36.0	16,219	30.5
Value	$494,013	17.8	$1,174,768	32.0	$1,232,354	28.1
From English colonies:						
Tons	44,726	84.5	31,138	64.0	37,025	69.5
Value	$2,765,043	82.2	$2,486,222	68.0	$3,147,365	71.9
Total						
Tons	52,932	100.0	48,664	100.0	53,244	100.0
Value	$3,259,056	100.0	$3,660,990	100.0	$4,379,719	100.0

The total import of teak is apparently stationary. Its value, however, greatly increased because of increase in price for this species, as its region of distribution is after all limited. The import of teak is chiefly from colonies, but within the last few years their share decreased, being compensated by increase in import from foreign countries, among which Siam and Java are the most important.

Mahogany.—The import of mahogany exceeds in quantity the import of teak and is also distributed among English colonies and the colonies of other countries. Table 97 shows the mahogany imports for the period 1900–1913.

TABLE 97.—AVERAGE ANNUAL IMPORTS OF MAHOGANY

Source	1900–1904	Per cent	1905–1909	Per cent	1910–1913	Per cent
From foreign countries:						
Cu. ft.	1,807,150	43.3	1,903,650	39.6	3,252,600	57.3
Value	$1,569,281	43.7	$1,526,431	38.6	$2,585,951	55.7
From English colonies:						
Cu. ft.	2,376,650	56.7	2,900,250	60.4	2,426,900	42.7
Value	$2,023,272	56.3	$2,424,602	61.4	$2,053,936	44.3
Total:						
Cu. ft.	4,183,800	100.0	4,803,900	100.0	5,679,500	100.0
Value	$3,592,553	100.0	$3,951,033	100.0	$4,639,887	100.0

As can be seen from this table, the quantity and value of import from the different sources have an alternating character. At times the import from English colonies is greater than from foreign countries; at others the reverse is true. Among the foreign countries France, Cuba, United States, and Mexico before the war exported large quantities of mahogany. The largest amount of mahogany came from West Africa from French, German, and English colonies. For the period 1900–13 African mahogany imports averaged $3,009,205 in value, or 75 per cent of the entire import of mahogany. The total import of mahogany into the United Kingdom as shown in the table is growing both in quantity and value.

Other Tropical Woods.—The average import into the United Kingdom during the same years of other tropical species besides teak and mahogany is given in Table 98.

In the import of tropical species of this group the largest amount comes from foreign countries, particularly the United States, which

Table 98.—Average Annual Imports of Other Tropical Woods

Source	1900–1904	Per cent	1905–1909	Per cent	1910–1913	Per cent
From foreign countries:						
Cu. ft.	5,553,650	53.6	5,879,900	60.0	6,570,250	68.0
Value	$3,903,045	64.9	$4,117,147	69.4	$4,586,608	73.5
From English colonies:						
Cu. ft.	4,794,450	46.4	3,909,750	40.0	3,079,950	32.0
Value	$2,241,408	35.1	$1,817,808	30.6	$1,648,060	26.5
Total:						
Cu. ft.	10,348,100	100.0	9,789,650	100.0	9,650,200	100.0
Value	$6,144,453	100.0	$5,934,955	100.0	$6,234,668	100.0

supplies 50 per cent of the entire import. The tropical woods imported from the United States do not originate there, but are merely reshipped through American ports.

Imports from Russia, Exclusive of Finland.—Since all the statistics given refer to the pre-war period the imports from Russia include also the imports from Finland. Since Russia and Finland were the chief sources of imports into the United Kingdom and since Finland is now independent of Russia, it may be of interest to determine the amount of timber imported from Russia alone. The following table shows for the years 1901–11 the import of timber into the United

Table 99.—Import of Timber from Russia into the United Kingdom

Year	Import from Russia and Finland	Import from Finland alone	Import from Russia alone	Per cent of import from Russia alone
	cu. ft.	*cu. ft.*	*cu. ft.*	
1901	120,322,350	50,498,400	69,823,950	58.0
1902	129,721,200	53,160,300	76,560,900	59.0
1903	140,206,100	68,921,450	71,284,650	50.9
1904	143,245,300	74,462,550	68,782,750	48.0
1905	143,346,950	65,283,950	78,063,000	54.4
1906	163,336,300	74,424,800	88,911,500	54.4
1907	174,502,500	64,565,450	109,937,050	63.0
1908	195,319,050	72,769,650	122,549,400	62.7
1909	208,606,500	71,262,100	137,344,400	65.8
1910	220,184,550	67,099,700	153,084,850	69.5
1911	218,994,200	72,982,700	146,011,500	66.6

Kingdom from Russia with Finland, from Finland alone, and from Russia alone.

The export of timber from Russia into the United Kingdom, which was about equal to that from Finland in 1903 and even below it in 1904, from 1905 began to increase so that by 1911 the import from Russia proper was almost double that from Finland. It may be of further interest to note that while the import from Finland remained stationary, the import from Russia proper showed an uninterrupted increase. This would indicate that the crowding out from the English market of the imports from France, Sweden, Canada, and partly from the United States, must be due entirely to the increase in exports from Russia, which up to the war was the chief source of supply of timber to the United Kingdom.

Wood Pulp.—English statistics do not indicate separately importations of pulp wood into the United Kingdom. Part of the pulp wood importations are included under pitwood. There are, however, statistics of imports of wood pulp into the United Kingdom separately from other wood and timber imports. Average annual imports of wood pulp into the United Kingdom during the five years 1909–13 amounted to the equivalent of 86 million cubic feet of standing timber. A small part of it has been re-exported, leaving 84,400,000 cubic feet for home consumption. The imports of wood pulp were distributed among the various countries as follows (in the form of standing timber):

From	*Cu. ft.*
Norway	35,100,000
Sweden	31,500,000
Other countries (mainly Russia and Germany)	8,600,000
Canada	6,500,000
Newfoundland	2,700,000

Of the total, 55 per cent was mechanical pulp and 45 per cent chemical. Of the mechanical pulp the total imports were 483,000 tons (equivalent to 48 million cubic feet of standing timber) of which Norway supplied 290,000 tons, Sweden 93,000 tons, and the British Empire 91,000 tons, including 64,000 from Canada and 27,000 from Newfoundland.

Of chemical pulp 377,000 tons (equivalent to 37,700,000 cubic feet of standing timber) were imported. Sweden was the chief source, with 231,000 tons. Norway supplied 66,000 tons and other foreign countries 80,000 tons. The imports from the British Empire, therefore, which were wholly mechanical pulp, amounted to only 11 per cent of the consumption of the United Kingdom.

The reason for such small import of wood pulp from other parts of the Empire, as in the case of pit props, is due not to shortage of supplies but to other economic causes. As a matter of fact, Canada has recently become one of the principal pulp and paper producing countries of the world. Yet she found it more profitable to send the bulk of her exports to foreign markets. The total exports of wood pulp from Canada averaged for the last few years 430,000 tons. Most of it has so far gone to the United States. The largest quantity exported from Newfoundland in any one year was 50,000 tons in 1914. The total exports of pulp from Canada and Newfoundland in 1914 amounted to over 480,000 tons. If this were all imported to the United Kingdom it would satisfy 56 per cent of the average United Kingdom requirements. As a matter of fact, even this export from Canada and Newfoundland does not represent the total output of wood pulp material produced in those countries because in 1914–15, the year of greatest export of wood pulp, 1,010,914 cords of pulp wood were also exported from Canada, all going to the United States. Since 100 cords of wood produce on an average a little over 77 tons of pulp, these 1,010,914 cords of pulp wood exported from Canada to the United States represent about 780,000 tons of pulp. Thus the Canadian export of pulp and pulp wood in 1914–15 represented about 1,230,000 tons of pulp; adding 50,000 tons from Newfoundland it will be seen that the actual exports of pulp from the Empire in 1914 were nearly 1,300,000 tons. This is over 50 per cent in excess of the requirements of the United Kingdom, yet the United Kingdom itself received only 11 per cent of the pulp it consumed from Canada and Newfoundland.

There are several economic reasons for this: (1) The cost of freight. Freight rates for wood pulp are higher to the United Kingdom from Canada than from Norway and Sweden. On the other hand, freights to the United States are lower from Canada than from Scandinavia; (2) the Canadian mills are mostly equipped at present for the manufacture of wet pulp, whereas 90 per cent of the chemical wood pulp imported into the United Kingdom in recent years was in the "dry" state; (3) the cost of production in Scandinavia is lower than that in Canada, the difference being due not so much to difference in the rate of wages as to lower initial capital charges and lower rates of interest. It is not likely that the existing conditions will change materially within the near future, and therefore the United Kingdom will still find it more profitable to import pulp from northeastern Europe, and Canada to export pulp to the United States.

The Most Important Timber Ports of the United Kingdom.—Table 100, based on official statistics of wood and timber imports into the United Kingdom through the various ports, gives a fairly clear idea of the importance of the different ports in the international timber trade. The largest importer of wood and timber is London. It receives nearly 17.5 per cent of the entire timber import to the United Kingdom. It is followed by Cardiff, 12 per cent; Hull, 9.4 per cent; Liverpool, 6.2 per cent; Hartlepool, 5.5 per cent; Manchester, 5.5 per cent; Newport, 3.9 per cent; and Newcastle, 3.8 per cent. In the aggregate, these eight cities import 64 per cent of the entire import to the United Kingdom. By value, the cities follow a different order, since such ports as London, Liverpool, Hull and Hartlepool import more valuable sawn lumber, while others, with Cardiff at the head, import round timber of small value and mining props. A comparison of the imports through these ports for 1913 with 1909 shows the changes that took place within the last five years before the war. For the great majority of them there was a marked increase in import which corresponds to the general increase of all kinds of timber to the United Kingdom for that period.

TABLE 100.—IMPORTS OF HEWN AND SAWN LUMBER INTO GREAT BRITAIN FOR THE YEARS 1909 AND 1913, BY PORTS. SAWN LUMBER INCLUDES SPLIT, PLANED, AND DRESSED LUMBER AND TIES, BUT NOT STAVES OR WOOD MANUFACTURES. (QUANTITIES IN THOUSANDS OF CUBIC FEET.)

Port	1909			1913		
	Hewn	Sawn	Total	Hewn	Sawn	Total
Aberystwith	...	85	85	...	89	89
Barnstaple	...	122	122	...	166	166
Barrow-in-Furness	1,877	746	2,623	1,409	1,814	3,223
Berwick	...	285	285	...	401	401
Blyth	258	650	908	...	2,459	2,459
Boston	1,557	753	2,310	642	1,922	2,564
Bridgwater	...	712	712	...	779	779
Bristol	...	6,661	6,661	...	7,842	7,842
Cardiff	45,338	9,113	54,451	57,144	9,167	66,311
Cardigan	...	49	49	...	29	29
Carlisle	...	64	64	...	132	132
Carnavon	...	160	160	...	136	136
Chester	...	105	105	...	121	121
Colchester	...	207	207	...	233	233
Cowes	...	210	210	...	247	247
Dartmouth	...	52	52	...	78	78
Dover	...	189	189	...	648	648
Exeter	...	543	543	...	614	614
Falmouth	...	122	122	...	179	179
Faversham	...	85	85	...	70	70
Fleetwood	19	1,375	1,394	...	651	651
Fowey	...	128	128	...	129	129
Gloucester	574	9,682	10,256	1,165	8,784	9,949
Goole	...	427	427	...	671	671
Grimsby	2,560	12,161	14,721	7,713	13,350	21,063
Hartlepool, West	19,563	7,166	26,729	20,434	8,345	28,779
Harwich	...	98	98	...	...	...
Hull	13,223	30,112	43,335	16,811	34,045	50,856
Ipswich	...	817	817	...	1,194	1,194
King's Lynn	...	2,514	2,514	...	3,269	3,269
Lancaster	...	281	281	...	31	31

TABLE 100.—IMPORTS OF HEWN AND SAWN LUMBER INTO GREAT BRITAIN FOR THE YEARS 1909 AND 1913, BY PORTS. SAWN LUMBER INCLUDES SPLIT, PLANED, AND DRESSED LUMBER, AND TIES, BUT NOT STAVES OR WOOD MANUFACTURES. *Continued.*

Port	1909			1913		
	Hewn	Sawn	Total	Hewn	Sawn	Total
Littlehampton	....	267	267	....	155	155
Liverpool	5,882	21,384	27,266	9,513	25,763	35,276
Llanelly	182	517	699	52	662	714
London	12,903	66,710	79,613	13,518	82,630	96,148
Lowestoft	346	1,218	1,564	327	1,481	1,808
Manchester	4,295	21,020	25,315	5,281	24,735	30,016
Maryport	....	81	81	....	70	70
Middlesbrough	1,998	677	2,675	1,393	666	2,059
Milford	2	149	151	8	144	152
Newcastle	9,196	7,159	16,355	13,630	8,117	21,747
Newhaven	....	841	841	....	876	876
Newport	14,136	3,205	17,341	18,326	3,492	21,818
Padstow	....	41	41	....	42	42
Penzance	1	107	108	....	36	36
Plymouth	143	2,213	2,356	535	2,608	3,143
Poole	....	1,172	1,172	....	1,145	1,145
Portsmouth	135	1,282	1,417	166	1,368	1,534
Port Talbot	3,996	246	4,242	3,788	244	4,032
Preston	....	4,219	4,219	....	5,427	5,427
Ramsgate	....	219	219	....	232	232
Rochester	98	146	244	96	230	326
Scarborough	....	48	48	....	47	47
Shoreham	....	571	571	....	694	694
Southampton	361	3,670	4,031	339	3,399	3,738
Stockton	....	122	122	....	81	81
Sunderland	2,913	2,483	5,396	3,698	2,557	6,255
Swansea	6,216	2,813	9,029	8,091	3,172	11,263
Teignmouth	....	219	219	....	182	182
Truro	111	701	812	80	822	902
Weymouth	....	267	267	....	294	294
Whitby	....	34	34	....	56	56
Whitehaven	191	494	685	315	258	573
Wisbeach	227	2,113	2,345	112	2,203	2,315
Yarmouth	176	3,516	3,692	312	4,653	4,965
Total, England and Wales	148,477	235,598	384,075	184,898	276,136	461,034
Castletown	....	34	34	....	37	37
Douglas	....	103	103	....	185	185
Ramsey	....	....	....	....	14	14
Total, Isle of Man	....	137	137	....	236	236
Aberdeen	1,611	2,212	3,823	2,085	2,102	4,187
Alloa	2,133	287	2,420	3,482	137	3,619
Arbroath	....	46	46	....	3	3
Ardrossan	1,407	920	2,327	....	1,143	1,143
Ayr	203	727	930	512	921	1,433
Banff	....	23	23	....	....	....
Barrowstoneness	7,697	325	8,022	10,881	970	11,851
Burntisland	611	15	626	320	....	320
Dundee	....	2,613	2,613	....	3,591	3,591

TABLE 100.—IMPORTS OF HEWN AND SAWN LUMBER INTO GREAT BRITAIN FOR THE YEARS 1909 AND 1913, BY PORTS. SAWN LUMBER INCLUDES SPLIT, PLANED, AND DRESSED LUMBER, AND TIES, BUT NOT STAVES OR WOOD MANUFACTURES.—*Continued.*

Port	1909			1913		
	Hewn	Sawn	Total	Hewn	Sawn	Total
Fraserburgh	....	237	237	....	264	264
Glasgow	1,309	6,287	7,596	2,725	7,244	9,969
Grangemouth	2,720	11,507	14,227	5,575	12,437	18,012
Granton	841	390	1,231	2,385	330	2,715
Greenock	261	1,936	2,197	293	1,590	1,883
Inverness	31	340	371	25	520	545
Irvine	....	207	207	....	339	339
Kirkcaldy	19	26	45	....	....	....
Kirkwall	....	43	43	....	57	57
Leith	337	5,005	5,342	359	6,088	6,447
Lerwick	....	87	87	....	210	210
Methil	1,632	1,002	2,634	1,128	985	2,113
Montrose	....	397	397	....	404	404
Perth	....	211	211	....	158	158
Peterhead	....	228	228	....	327	327
Stornoway	....	28	28	....	80	80
Stranraer	....	11	11	....	13	13
Troon	....	82	82	....	139	139
Wick	20	201	221	....	225	225
Wigtown	....	19	19	....	....	....
Total, Scotland	20,832	35,412	56,244	29,770	40,277	70,047
Belfast	571	5,819	6,390	838	6,616	7,454
Coleraine	....	45	45	....	34	34
Cork	....	1,347	1,347	18	1,469	1,487
Drogheda	....	....	....	....	20	20
Dublin	423	4,583	5,006	268	4,204	4,472
Dundalk	146	63	209	....	400	400
Galway	....	133	133	....	204	204
Limerick	....	812	812	2	1,513	1,515
Londonderry	....	610	610	....	738	738
Newry	....	286	286	....	239	239
Skibbereeen	....	99	99	....	73	73
Sligo	....	175	175	....	124	124
Tralee	....	294	294	....	255	255
Waterford	....	489	489	....	526	526
Westport	....	....	....	....	50	50
Total, Ireland	1,140	14,755	15,895	1,126	16,465	17,591
Grand total	170,449	285,902	456,351	215,794	333,114	548,908
England and Wales	148,477	235,598	384,075	184,898	276,136	461,034
Isle of Man	....	137	137	....	236	236
Scotland	20,832	35,412	56,244	29,770	40,277	70,047
Ireland	1,140	14,755	15,895	1,126	16,465	17,591

Probable Future.—The United Kingdom, with highly developed wood-using industries and only a small area of forests within her own boundaries, must continue to import large quantities of timber from her colonies and protectorates, as well as from foreign countries and their colonies. A most significant fact, however, is that the colonies of Great Britain on the whole play a comparatively insignificant part in importations of wood and timber as compared with the importations from foreign countries, particulary northeastern Europe. In spite of an enormous forest area of some 1,376,000,000 acres (including the former German colonies in Africa) within the boundaries of the British Empire, the United Kingdom utilizes those resources only to a limited degree and turns to foreign countries for making up her deficit in timber. What share will these enormous timber resources have in supplying the future timber requirements of the United Kingdom? Will the requirements continue to be supplied by northeastern Europe or will the latter be gradually replaced by the timber resources from other parts of the British Empire? First among the reasons for the backwardness of the British colonies in supplying the markets of the mother country is their remoteness. Because of the distance only those species and grades of timber can be profitably imported which, because of their high price on the English market, can afford to stand the high cost of transport. The nearest eastern port of Canada, Halifax, is 2,485 nautical miles from the British Isles. The other forest possessions of Great Britain are at even greater distances—West Africa, 3,500 miles; West India (Bombay), 6,000 miles; Burma, 7,500 miles; Australia (Sydney), 12,235 miles; British Columbia (Vancouver), 14,614 miles.

Of all of these colonies, only Canada has coniferous species, which are particularly valued for structural purposes in England because with their lightness and softness they possess sufficient strength and durability. Such excellent species as eucalyptus, greenheart, and others, have advantages over common coniferous species in hardness and durability, but because of their great weight and hardness require larger expense in utilization and therefore are less adapted for common construction and for every-day use in trade and arts. Furthermore, the tropical and subtropical colonies do not offer most favorable conditions for efficient timber utilization. On account of the hot climate the wood cracks so badly that logs of enormous dimensions in the final result barely yield sizes suitable for ordinary boards, ties, beams, etc. Because of the great waste, the prices are very high.

These geographic and climatic handicaps will always remain an important factor in the efficient utilization of the timber resources of the British colonies. There are, however, other temporary causes which will postpone for some time the utilization by the mother country of her colonial timber resources. Among these are the sparse population and lack of means of communication. British possessions in Australia, Africa, and Asia abound in virgin forests, and yet the same colonies buy considerable quantities of northern European and American coniferous timber which successfully competes with the native species. The reason for that is the comparative inaccessibility of the local forests and therefore the high cost of transport to places of consumption. Furthermore, the lack of labor also adds to the cost of exploitation, with the result that it is more profitable to bring timber from Sweden or British Columbia, thousands of miles away than to cut and saw it on the spot. Where the colonies are densely populated, as is the case with British India, the timber resources are barely sufficient for the needs of the native population.

The situation of Canada is different from that of other colonies of Great Britain. It is comparatively near to the mother country and its forests contain the species which are required by the English market. The forests of Canada, however, especially in the eastern part where they have been utilized longest, are now greatly depleted. With the depletion of the timber resources of the United States, Canadian timber finds a more profitable market in the United States because of its proximity and very cheap means of transport. Should Canada bring her forests under management, with her large forest area and still comparatively small population, she could supply the needs of European countries, but this would take time and certain favorable economic conditions.

An enormous source of supply of species and grades particularly suitable for English needs is British Columbia. Although the Panama Canal has reduced the distance between Vancouver and Liverpool from 14,614 to 8,859 miles, still the distance is too great to permit of the shipment of any but the better grades of timber. Shipments from New Orleans and Pensacola, which are only half as far as Vancouver from Liverpool, are limited, because of the high freight rate, to the more valuable grades of lumber. Much more is thus true of shipments from Vancouver. Although the Panama Canal may facilitate the competition of Canadian timber on the European market, a large part of it will find an outlet to the Pacific Ocean and the markets of the Far East, China, and Australia.

From all this we may safely infer that under the present economic conditions it is not likely that Great Britain can utilize the resources of her own colonies to better advantage than the timber from foreign countries lying closer at hand. This deduction finds confirmation in the considerable reduction of the imports to the United Kingdom from her colonies, and especially from Canada, during the last decade before the war.

Movement of the Price of Timber.—Since the United Kingdom buys nearly 92.6 per cent of her wood and timber from all the countries of the globe, the wood prices in the English market affect practically the whole world. It will therefore be of interest to compare prices for the different kinds of wood imported over a long period of years. The following average annual import prices for several kinds of timber by decades from 1853 to 1913 are borrowed from the Joint Annual Report of the Forestry Branches for 1912–13, published by the Board of Agriculture and Fisheries, Office of Woods, Forests, and Land Revenues.

It is noticed that the price of hewn timber fell consistently throughout the whole period. Saw timber fluctuated, reaching its lowest point in 1883–92, but subsequently reaching its highest point since 1853-62. Staves are of small importance compared with the other two items but they too reached their lowest point in 1883–92. If the quantities and values of all three kinds of timber are totaled for each decade it appears that the average price per cubic foot fell consistently until 1883–92 and since then there was an upward tendency, as may be observed from the following table:

Price per cubic foot	1853–1862	1863–1872	1873–1882	1883–1892	1893–1902	1903–1912
Hewn	$0.33	$0.31	$0.27	$0.21	$0.19	$0.18
Sawn	0.29	0.25	0.26	0.22	0.24	0.27
Staves	0.72	0.88	0.59	0.41	0.46	0.45
All kinds	$0.32	$0.28	$0.27	$0.22	$0.23	$0.24

During the war, of course, the prices increased enormously. Thus, taking the average prices of 1909–13 as 100, the average price of hewn timber was 181 in 1915 and 241 in 1916; pitwood 186 and 287 and staves 131 and 199, respectively. Since the war prices were abnormal they can not be considered as indicating the natural trend in the United Kingdom. The movement of prices of timber in comparison with the price level of other commodities is graphically represented in Fig. 8. The fact remains that in spite of certain fluctuations the actual prices for wood and timber in the United Kingdom just before the war were lower than several decades ago. In timber-exporting countries which are devastating the forests, or timber importing countries less favorably situated as regards transportation facilities, no such lowering of timber prices can be recorded. There may be several reasons ascribed for these movements of prices. It is doubtless safe to ascribe the general fall in price until the decade 1883–92 to the great development in transport facilities in the second half of the 19th century and to the opening up of very large new sources of supply. In the case of hewn and round timber it may also be accounted for by a change in the kind and quantity of logs imported. In the 70's the importations consisted chiefly of large logs, while in more recent times the timber imported was generally of smaller sizes and a great deal of it was for mine timbers and pulp. The tendency for the prices to increase slightly since the period 1883–92 may be due to the exhaustion of many virgin forests and shrinking of the sources of supply, as is indicated by the decrease of importations from Norway, Sweden, the United States, and Canada, as well as to the development of industries and, therefore, greater use of wood and timber in the exporting countries themselves. Furthermore, the course of prices of timber during the last century has been affected also by the general movement of prices. There is a general consensus of opinion, however, that the quality of timber on the market is becoming on the whole progressively inferior, and therefore while actual prices may appear lower than the prices of several decades ago, when the quality is considered they may be the same or relatively even higher now than before.

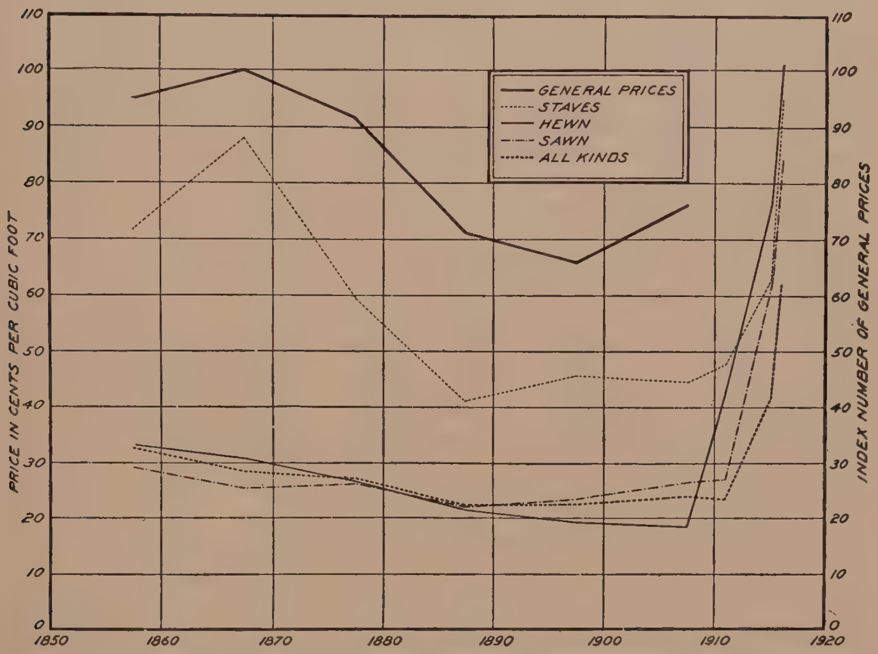

Fig. 8.—Movement of timber prices in comparison with general commodity prices in the United Kingdom, 1857–1916.

The enormous increase in prices during the war brings out the great dependence of the United Kingdom on foreign sources of supply, and points to what may happen to the prices if the sources of supply become exhausted or for some other reason less accessible to the market of the United Kingdom.

The Forestry Movement.—The growing realization in the United Kingdom of the dependence of her lumber and wood-using industries upon imports from foreign countries, together with the fear of the possible exhaustion of those resources, led to the movement for increasing the forest area by planting some of the mountain and moor lands. The movement dates back to 1885, although public inquiries on the management of the Crown forests were held as early as 1833, 1848, and 1863. The Select Committee of 1885–87 was, however, the first of a series of committees which considered forestry from a national standpoint. The experience which the United Kingdom went through during the war in procuring pit props, so essential for her mining industry, and other timber, intensified this movement. It finally culminated in 1919 in the appointment of a Forestry Commission, which is to carry out the plan outlined in 1918 by the Forestry Sub-committee of the Reconstruction Committee.

The plan provides first for making the United Kingdom independent of imported timber for three years in an emergency. This necessitates, in addition to improving the yield from existing forests, the afforestation of some 1,770,000 acres of land. The average rotation decided upon is 80 years. Two-thirds of the entire area should be planted in the first 40 years. The area to be planted in the first 10 years is to be limited to 200,000 acres in view of the difficulties that may be encountered in the beginning.

Of the 200,000 acres to be planted during the first 10 years, 150,000 acres are to be planted by the state and 50,000 acres by public bodies and private individuals, assisted by grants of cooperation between them and the state. The estimated cost for the first 10 years is $16,645,500. The total investment during the first 40 years will amount to $72,900,000. After that time the enterprise is expected to become self-supporting. The afforestation plans of the United Kingdom have thus assumed definite form.

The Forestry Commission during 1920 planted 1,500 acres of land in various parts of the country. In 1921 it was planned to plant 5,600 acres. A large proportion of the planting in the United Kingdom is to take place in Scotland, where there are extensive lands highly suitable for forest purposes which may be acquired at very low prices. Similar tracts of land in the northwestern part of England, embracing the counties of Cumberland and Westmoreland, are being marked out for forest development. The greater portion of these lands is not suitable for agricultural purposes. It is estimated that an average yield of 60 cubic feet per acre per annum may be obtained from the poor and medium quality land. Allowing 30 cubic feet to the ton, two tons of forest products are expected from each acre each year. The program provides that no more grazing land shall be acquired for forest purposes than will reduce the meat supply of the country by 0.7 per cent at the end of 80 years, and that nothing shall be done to disturb the land on which sheep may be extensively and profitably raised.

It is of interest to consider to what extent this afforestation program of the United Kingdom will affect her imports from foreign countries and may influence the handling of the forests in the countries which supply the bulk of English requirements. There are many forest experts in the United Kingdom itself who are strong advocates of the afforestation program, but for social and national reasons rather than for business considerations. A. C. Forbes, Chief Forestry Inspector of the Department of Agriculture for Ireland, who made a careful study of the financial aspects of afforestation, comes to the conclusion that of the three types of land suitable for forest planting the better lands promise a net revenue of $1.68 per acre per annum. The yield from the intermediate lands at the prevailing prices for wood and allowing interest on the capital invested of 3 per cent, represents a loss of $2.53 per acre per annum. On the poorest land there may be expected an annual revenue of $0.13 per acre. Since the better lands are level valleys suitable also for agriculture, the hilly lands embracing the intermediate and poorer soils will make up most of that available for forest planting. Since the revenue from the better lands is lower than present revenues from agriculture, for which they are now used, and the revenue from the poorest land is about what it yields now managed for game, the profitableness of the afforestation program as a business enterprise may be questioned. This is particularly true since coniferous forests about 50 years of age well situated as regards transportation to ports may now be bought in Sweden for much less than it would cost to grow such plantations at home. At the time of hearings on the afforestation program some experts expressed the opinion that the value on the open market of the timber that would be obtained from the area of 150,000 acres, to be planted during the first 10 years would be only one-fourth the cost of growing it.

It may therefore be safe to assume that, as long as the economic conditions remain as they are now, the United Kingdom in normal times will find it more profitable to secure its raw material of wood and timber from foreign countries. Conditions, however, may change within the next 25 years when the prices for timber, especially pit wood, may reach levels that would make it more profitable to grow it at home than to secure it from abroad. This is particularly true of pit props, which are of vital importance to Great Britain. The price for such material, which is so extensively used in the manufacture of wood pulp and for mining timbers, is rapidly increasing and several countries have attempted to prevent the export of such young timber from their forests. Canada, Sweden, and Finland have an export tariff on small coniferous timber; Russia before the war adopted similar measures. These were temporary measures, but will undoubtedly become permanent in time. Because of the demands for spruce for pulp wood the small-sized spruce logs command the same price as pine. Under such conditions the import of small-sized coniferous timber to the United Kingdom may be greatly curtailed, and it is just the kind of material that can be most quickly grown at home. On the whole, therefore, it would seem that the afforestation program in Great Britain will not materially affect, at least for a generation, the amounts of timber that she will need for maintaining her industries.

In connection with the afforestation plan, the committee has also proposed the revision of the taxation of forest property and of the railway freight rates.

The Forestry Commission consists of eight members appointed by the Crown for a period of five years. Three of the commissioners are paid officers and one of them is a technically trained forest officer. The country is divided into three districts in charge of assistant commissioners, one for England and Wales, one for Scotland, and one for Ireland, with offices in London, Edinburgh, and Dublin, respectively. Under the assistant commissioners are divisional officers. England and Wales have five, Scotland four, Ireland two, each with a definite territorial charge. The divisional officer is an experienced forest officer and has as assistants junior forest officers. The divisional officer is responsible for all state forestry work in the division as well as for advice to private owners. Aside from the main purpose of the Forestry Commission—reforestation of non-agricultural land—it has general control of forest education, forest research, and publications. The Commission meets as a body once a month for the decision of matters of policy and to review progress.

Forest Activities of Municipalities and Private Owners.—Although until recently the state has done very little in the practice or encouragement of forestry, municipalities, corporate bodies, private companies, and private owners have shown considerable enterprise in forest matters. During the last half century municipal bodies have come more and more into possession of large tracts of hilly country which serve as catchment areas for their water supply. Dr. A. Henry, in a recently published book on "Forests, Woods and Trees," enumerates catchment areas aggregating 1,451 square miles in which the water rights are held by 250 local authorities and 14 private companies. Of these 88 local authorities and one private company own 286½ square miles of the land itself, or more than one-fifth of the whole. Eight local authorities have adopted schemes of afforestation, and 9¾ square miles had actually been planted by 1918. The municipalities which have plans for afforestation are as follows:

Corporation of Manchester.
Corporation of Liverpool.
Corporation of Leeds.
Corporation of Birmingham.
Bury and District Joint Water Board.
Middle Ward of Lanark District Committee.
Edinburgh District Water Trust.
Dundee Corporation.

Some university colleges and same state departments, such as the Duchy of Lancaster, Duchy of Cornwall, and Ecclesiastical Commissioners, are also holders of woodland. The total area is approximately 34 square miles The activities of these bodies have consisted chiefly in maintaining their existing woodlands, although the Duchy of Cornwall has recently begun planting at the rate of 250 acres a year. The plan calls for the ultimate afforestation of some 8 square miles.

Societies Interested in Forestry.—There are in the United Kingdom a number of societies which have kept the interest in forestry alive during the many years of inaction on the part of the state. Among these are the following:

The Royal Scottish Arboricultural Society, founded in 1854, and now comprising 1,750 members. Its work so far has been educational in character. The Society's principal publication is the "Transactions," appearing twice yearly.

The Royal English Arboricultural Society, founded in 1882. The Society has nearly 1,400 members and its purpose is the promotion of forestry in the United Kingdom. The Society publishes a Quarterly Journal of Forestry.

The Irish Arboricultural Society. This Society is similar in character to the Royal Scottish Arboricultural Society and the Royal English Arboricultural Society, except that its activities are confined to work in Ireland.

Closely connected with the arboricultural societies are the English Forestry Association and the Landowners' Cooperative Forestry Society of Scotland.

The English Forestry Association has for its purpose the organization of the market for British timber by encouraging increased demand for forest products and by bringing together the producers and consumers of timber.

The Landowners' Cooperative Forestry Society of Scotland, which is now about nine years old, aims at obtaining by collective effort results which could not be realized by individual members. Its purpose is frankly commercial. Since private timber owners are usually at a disadvantage in disposing of their timber, the Society provides experts for its members for estimating their standing timber, advising them as to the most advantageous prices obtainable for their products and devising new outlets for the manufactured products and means for cheapening the cost of timber production. It helps its members in the proper grading of timber.

There are several other societies in which forestry forms a smaller or larger part of their activities. These are:

The Surveyors' Institution (founded in 1868). This has a section dealing with the management of timberlands. Members of the Institution are frequently called in to report and advise on matters affecting forestry. The "Transactions," published by the Institution for the past 50 years, contain many papers and discussions on forestry.

The Land Agents' Society (founded in 1902). This Society has four principal objects: (1) to promote and protect the interests of the profession of landed estate agents; (2) to advise by mutual conference on all matters of practice relating to the management of landed estates; (3) to disseminate information by means of publications, correspondence, and so on, and (4) to criticize legislation on matters affecting the interests of agriculture and land generally. It has a membership of 1,126, and publishes "The Journal of the Land Agents' Society."

Among other societies which have taken part in the advancement of forestry in the United Kingdom are: *The Royal Agricultural Society of England, The Highland and Agricultural Society, The Scottish Estate Factors' Society,* and *The Central Landowners' Association.* There are also several societies representing specific trade interests. The most influential among these is the *Timber Trade Federation,* formed in 1893. Its purpose is to promote the common interests of the timber industry of the United Kingdom. Associated with this Timber Trade Federation are the *Home Timber Merchants' Association of Scotland,* and the *North of Scotland Home Timber Merchants' Association.*

Education and Forest Research.—Systematic education in forestry began in 1885, when a course of instruction limited to candidates for the Indian Forest Service was instituted at the Royal Engineering College, Coopers Hill. In 1891 a lectureship in forestry was established at Edinburgh University, which has continued uninterruptedly up to the present time. In 1904, at the University of Wales at Bangor, and at Armstrong College in Newcastle-on-Tyne, instruction was provided for timber owners, foresters, and woodsmen. In 1905 the teaching staff of Coopers

Hill College was transferred to the University of Oxford, and two years later instruction in forestry was also instituted at Cambridge University. In the North of Scotland lectures have been delivered at Aberdeen University in connection with the College of Agriculture since 1898, and in Ireland a professorship was founded at the Royal College of Science at Dublin in 1913. At the present time instruction in forestry is obtainable at the following universities and colleges:

Oxford University.
Cambridge University.
University of Wales.
The Armstrong College (University of Durham).
Edinburgh University.
Aberdeen University.
Edinburgh and East of Scotland College of Agriculture.
Royal College of Science.

Forest research is now provided for under the Forest Commission as well as at the Imperial College of Science and Technology at London.

There are several schools for foresters of lower grades. Such schools have now been established at Parkend in the Forest of Dean, Gloucestershire; Burley in the New Forest, Hampshire; Chopwell, Rowlands Gill, near Newcastle, County Durham; Beaufort, Beauly, Invernessshire; Avondale, Rathdrum, County Wicklow.

The training in forestry of a limited number of partially disabled men is being undertaken at Birnam, in Perthshire, and at Brockenhurst, in the New Forest. A course is also given under the direction of the Forestry Commission for landowners in the Forest of Dean and in Tintern Woods.

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GREECE

Forest Area.—About 90 per cent of the surface of Greece is classified as mountainous, and between 50 and 60 per cent of the total land area, or 16,302,000 acres, is essentially forest land, hence timber should normally be very abundant. But wars, burning, overgrazing, and clearing for agricultural purposes have been depleting the forests for centuries, until they are now capable of supplying little but fuelwood, and Greece is obliged to rely on importation to supply her growing demand for building material, and especially for wood used in making boxes and barrels for the native fruit-export trade The country, however, is by no means entirely treeless. Although strips along the coast and most of the islands have long since been deforested, the interior still contains fine forests.

The total forest area has never been exactly determined, owing to the lack of reliable land surveys. The figures regarding the extent of the forests are therefore largely estimates.

About the middle of the last century (1854) Greece included only the Peloponnesus, Central Greece, the Cyclades Islands, and Euboea. The land area at that time was 11,826,854 acres, of which about 1,420,250 acres, or 12 per cent of the total area, was forested. The forest area was estimated by Dr. Chloros in 1884 at 2,025,400 acres, or 12.68 per cent of the total, including the Ionian Islands and Northern Greece, which had been acquired in the meantime and increased the area of the country to 15,970,526 acres. A recent Greek authority on forestry matters, P. Kontos, places the forest area of Greece in 1906 at about 18 per cent, or 2,875,080 acres. This estimate is probably too high, and can be explained only by assuming that the author included under "forested area" lands formerly covered with forest but now denuded.

Few data are available upon which even an estimate of the present forest area of Greece can be based. The addition of the provinces acquired after the Balkan wars in 1913 practically doubled the original area of the country. The newly incorporated territories, especially Northern Epirus and Macedonia, are very heavily wooded (fir and oak); and during recent years there has been considerable activity in reforestation (in Crete, Attica, Peloponnesus, etc.). It would probably be an approximation of the facts to estimate the present forest area at about 4,446,000 acres, or 15 per cent of the entire 29,654,326 acres. This represents 0.94 acre per capita of the population. Within this forest area is included brush forest, which covers extensive areas. The forests of Greece are generally light, and produce chiefly fuelwood. A considerable portion is not exploitable, owing to lack of natural and artificial means of transportation.

Character of Forest.—The forests of Greece are divided into three regions, in many localities very sharply defined, according to the dominant species.

The first of these regions is characterized by small evergreen broadleaf species, and lies below 2,600 feet altitude. This region divides naturally into two sub-regions, the first characterized by a warm, dry climate, the second colder and moister. Although *Pinus sylvestris, Pinus halepensis, Cupressus sempervirens, Robinia pseudacacia* and *Alnus glutinosa* are occasionally found in both sub-regions, the typical trees are *Pistachia lentiscus* in the first, and *Quercus coccifera* and *Arbutus* in the second.

The second principal forest region is that of deciduous broadleaf species, between 2,600 and 4,900 feet above sea level. The lower part of this region contains the most important oaks, *Quercus robur, Q. conferta, Q. pedunculiflora, Q. pubescens, Q. pedunculata, Q. sessiliflora,* and others. Oak has been so common throughout Greece since antiquity that the ancient name for this species was simply "dendron," or tree. Chestnut is found higher up on suitable sites, and throughout the region many other species occur, such as ash, hornbeam, walnut, poplar, plane, elm, maple, linden, and dogwood. Above this region is beech (*Fagus sylvatica*), which attains excellent development in northern Greece.

The region of conifers (about 4,900 to 6,600 feet above sea level) contains fir, pine, yew, and juniper in several varieties. The conifers are not confined to this altitude, however, but are also found at 2,300 to 3,000 feet either individually or in small groups. The vegetation of the alpine region, which begins at about 6,200 feet, consists only of mosses and lichens.

Fairly accurate data on the percentage of various species in the forests of Greece are available only for the old provinces, or Greece prior to 1913. The proportion is approximately as follows:

	Per cent
Aleppo pine	35
Fir	25
Oak	20
Corsican pine	5
Beech	5
Miscellaneous	10

Thus conifers, particularly pine, form 65 per cent of the forests of Greece.

Aleppo pine occupies large areas in the warm, dry regions, at low altitudes, especially in Attica and the Peloponnesus, and is used chiefly for turpentining. *Abies cephalonica,* or Grecian fir, is the chief species of the high mountains. In Northern Greece fir extends down to 600 feet above sea level, and in the latitude of Athens gradually replaces Aleppo pine. There is a large forest of fir in the central part of Arcadia, covering about 39,520 acres. This forest is one of the largest in Greece, and is in fairly good condition. *Abies pectinata* is very rare, being found in only a few places, as on Mt. Athos. Corsican pine occurs from 3,200 to 5,200 feet altitude, especially in the mountains of Thessaly, Euboea, on Mt. Parnassus, in the Peloponnesus, and on the northern slopes of Parnon and Taygeta. It is also occasionally found at much lower altitudes. Beech usually occurs in nearly unmixed stands on moist sites in the northern part of Greece, at between 1,640 and 4,900 feet altitude, especially on Mt. Pelion and Mt. Ossa. Chestnut is generally found at lower altitudes than beech, on the slopes of Pelion and Ossa, and also in Euboea and in different parts of the Peloponnesus. Oaks are widespread throughout Greece, usually not above 3,000 feet altitude, although they sometimes occur as high as 3,300 to 4,000 feet in the Peloponnesus.

Character of Ownership.—No accurate data are available on the ownership of the forests of Greece, for conditions in this respect are very much complicated. Frequent disputes over boundaries occur, especially between the communes and the Government, and the laws are not enforced. The following categories of forest ownership may be mentioned:

1. State forests. By far the greater part of the forests—about 80 per cent—are owned by the state, although the meaning of state ownership in Greece is different from that in France or Germany. The people regard the forests as common property, which the government merely administers. This view of state ownership is the cause of a very strange and primitive system of forest utilization—the so-called "cutting-permit system." Under this ruling, cutting permits are granted to individuals, who go into the forest and cut the trees they want, quite without regard to the size and location of the trees or to regeneration of the forest. This practice is productive of great waste, and as a rule more timber is cut secretly than the permit authorizes. Lack of adequate forest personnel aggravates this unfortunate condition.

2. Private forests. These forests form a disproportionately small part of the total, compared to the state forests. They are under technical supervision, and the law specifies that private forests over 1,250 acres in extent shall be guarded by forest rangers. This law has never been enforced, however. A certain percentage of the cut of private forests is claimed by the government as a tax—12 per cent of the market value of rough timber, and 18 per cent for sawn timber. Grazing rights, on the other hand, are taxed at only 8 per cent, a very low rate in contrast to the excessively high tax on timber.

3. Community and ecclesiastical forests. Community forests are next in extent to the state forests. The largest area of community forests is in Thessaly, in Northern Greece. Laws have been passed regulating utilization of these forests, but in this case also the laws exist on paper only. Cutting and grazing are carried on practically without limit. The ecclesiastical forests are gradually passing into the hands of the state. The few still remaining are usually leased.

Annual Cut.—The volume and money yield of the state and private forests of old Greece for the years 1903 and 1913 are shown in the following table:

TABLE 101.—YIELD OF GREEK FORESTS

Kind	1903		1913		Average	
	Volume	Value	Volume	Value	Volume	Value
	cu. ft.		*cu. ft.*		*cu. ft.*	
Industrial timber (all kinds)	2,631,000	$791,270	1,482,600	$399,840	2,056,800	$595,555
Fuelwood	2,324,000	146,873	5,020,700	380,800	3,672,400	263,837
Total	4,955,000	$938,143	6,503,300	$780,640	5,729,200	$859,392

The actual cut, considering the extravagant methods of cutting, is perhaps one-third more than the total average volume of timber and fuel, or 7,786,000 cubic feet. To these figures must be added the volume cut free of charge by inhabitants of the communes for domestic uses, the large amount stolen, and the wood consumed in the manufacture of charcoal. All these important quantities of wood elude the statistical reports, but if they are estimated at 52,950,000 cubic feet the average total annual yield of the forests of old Greece would be 60,736,000 cubic feet. This includes rough and sawn timber and wood used for domestic purposes and for fuel and charcoal. The total value is estimated at $10,472,000, or 8.5 per cent of the total national production of $123,760,000. No data are as yet available for the yield of the forests of the newly acquired territories, but no mistake would be made by estimating it as about equal to that of old Greece. The total cut from the forests of Greece may then be placed at 121,432,000 cubic feet, or 27.31 cubic feet per acre.

Annual Growth.—No figures are available as to the average annual growth per acre. Considering that the forests are exposed to unrestricted grazing and to fires, and that forestry is still in its infancy, the growth must fall below the cut. An annual growth of about 20 cubic feet per acre, or about 90 million cubic feet for the entire forest area, is probably a fairly liberal estimate. At this rate, the cut exceeds the annual growth by about 31 million cubic feet. Much of the forest area has in recent times been subjected to severe conflagrations. These have often been the work of shepherds wishing larger pasture grounds, or are due to carelessness or other causes. Considerable damage is also being done by goats grazing on young saplings.

Domestic Consumption.—The total wood production of old Greece has been estimated at 60,736,000 cubic feet. Calculating the average excess import at about 4,450,000 cubic feet, the total consumption amounts to 65,186,000 cubic feet, or 26.5 cubic feet per capita of the population according to the census of 1907. This, however, does not take into account the large quantities of charcoal imported into Greece annually. The imports of charcoal represent 1,362,000 cubic feet in the log. If the charcoal were added to the per capita consumption the latter would be increased to about 27 cubic feet. Probably not more than 10 cubic feet of this consists of structural timber, the rest being fuelwood.

Although the figure given for the per capita consumption is for old Greece, it probably also applies to Greece as it is now constituted. In that case the total annual consumption would be in the neighborhood of 127,000,000 cubic feet.

Imports and Exports.—Greece is a wood-importing country, and this has been the case since antiquity. Much timber for ship building and other purposes was imported then, since the forests even at that early date were heavily cut and produced chiefly fuelwood. The lack of industrial timber probably accounts for the strict limits and heavy duties placed by the ancient Greeks on exports of wood.

Coniferous woods far exceed broadleaf species in the timber imported by Greece. The imports of coniferous woods, including rough and sawn timber for shipbuilding and other construction purposes, amounted to 3,572,000 cubic feet in 1911, while the import of broadleaf timber in the same year was only 195,000 cubic feet. Pitch pine has steadily replaced oak for shipbuilding purposes, and the import of beech for manufacturing casks is also increasing. The import of boards for currant boxes has begun to decrease, owing to the establishment of native sawmills, which work up rough timber for this purpose. Coniferous wood is generally used for currant boxes, and this has contributed largely to the great increase in imports of such woods.

Reliable data on the situation of the wood trade are available only for "old Greece," and do not include the territories acquired at the close of the Balkan war in 1913. The commerce of Greece in timber, forest products, and fuel for 1890, 1895, 1900, and 1908 to 1911 inclusive, is shown in Table 102.

TABLE 102 — IMPORTS AND EXPORTS OF WOOD AND OTHER FOREST PRODUCTS

Imports

Kind of Product	1890	1895	1900	1908	1909	1910	1911
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Industrial timber....	3,206,000	1,914,000	2,823,000	3,659,000	3,699,000	3,808,000	3,767,000
Wooden articles......	473,000	376,000	241,000	583,000	449,000	436,000	466,000
Fuel..............	107,000	88,000	170,000	212,000	164,000	402,000	249,000
Total.........	3,786,000	2,378,000	3,234,000	4,454,000	4,312,000	4,646,000	4,482,000
Charcoal...........	286,000	281,000	1,028,000	892,000	995,000	1,179,000	1,362,000

Exports

Kind of Product	1890	1895	1900	1908	1909	1910	1911
	tons	*tons*	*tons*	*tons*	*tons*	*tons*	*tons*
Knopper galls.......	....	....	....	10,536	9,525	5,316	8,432
Gallnuts...........	....	....	....	6	40	66	18
Resin..............	....	....	....	1,703	2,056	5,595	7,802
Turpentine oil.......	....	....	....	526	758	1,229	1,562
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Fuel...............	15,000	35,000	6,000	9,000	....	2,000	1,000
Industrial timber (rough softwoods)..	1,000	1,000	....	....	....	....	2,000
Total.........	16,000	36,000	6,000	9,000	....	2,000	3,000
Excess of imports over exports.......	3,770,000	2,342,000	3,228,000	4,445,000	4,312,000	4,644,000	4,479,000

According to the above figures, the imports of industrial timber show an upward tendency, with the single exception of the year 1895, when they fell off on account of the general financial depression. The import of fuelwood fluctuates, but increases on the whole, while export of fuelwood clearly tends to decline. The import of charcoal increases steadily.

Table 103 shows the countries furnishing wood to Greece in the order of their importance, with the volume and percentage of the import from each country.

The wood export trade of Greece may be disposed of in a few words. The chief buyers of knopper galls are Austria, Italy, and Germany, while gallnuts are sent almost exclusively to Turkey and Austria. By far the greater part of the resin is exported to Germany, Italy, and Austria, and the very small export of fuelwood is shipped exclusively to Egypt and Turkey.

Table 103.—Wood Imports into Greece—1911

Country	Industrial timber		Other forest products (except fuel)	
	Cu. ft.	Per cent	Cu. ft.	Per cent
Austria-Hungary	2,094,879	55.61	129,127	27.72
Rumania	992,813	26.36	12,743	2.73
Turkey	309,616	8.22	216,954	46.57
Russia	95,239	2.53	22,168	4.76
Germany	48,149	1.26	424	0.09
Italy	46,243	1.23	56,974	12.23
France	14,297	0.38	2,542	0.55
Others	165,839	4.41	24,887	5.35
Total	3,767,075	100.00	465,819	100.00

Wood-Using Industries.—*Sawmills.*—There are seven steam sawmills in Greece; four in Patras, which saw native beech timber for the currant-box trade, and one each in Piraeus, Zante, and Aegion, in which rough timber imported from Rumania, Turkey, and Bosnia is worked up.

Forestry Laws.—Greece has no forest code. The laws consist of a large number of scattered statutes, some of which are out of date. The inadequate character of forest legislation has been recognized in recent years, and steps have been taken to supply the deficiencies. Two recently enacted laws are especially deserving of mention. One of these deals with forest fires. The forests of Greece, especially those of the plains regions where Aleppo pine is the dominant species, are very much exposed to fires, which are sometimes deliberately lighted by the peasants. A law passed in 1914 prescribes effective measures for decreasing the number of fires and also for mitigating their disastrous effects. This law forbids lighting of fires in the forests during the summer, and provides for the construction of fire lines and for the isolation of burned areas for a period of ten years. Another law, passed in May, 1918, provides for the creation in each department of a reforestation commission, including the chief of the department and four other members. These commissions are authorized to select land which is in need of reforestation or protection. It is likely that reforestation will be carried on either by private owners of forest lands, or by the state after acquisition of such lands by purchase or expropriation. Protection will probably consist largely of regulating or prohibiting grazing and cutting.

Certain much-needed reforms will probably soon be brought about by two new laws passed by Parliament in December, 1918. The first of these laws regulates methods of management in the state, communal, and institutional forests; revises present customs with regard to rights of usage, especially the gathering of fuel by the peasants; and slightly modifies certain tariff regulations now in force. The second law lays the foundation for reorganization of the forest personnel.

All the forests of Greece, regardless of ownership, are theoretically under management. All owners of forests are required to submit each year for the approval of the Minister of Agriculture the cuttings which they propose to make during the following year. An official decision based on the opinion of the local service, fixes the amount, location, nature, and time of the cutting. Furthermore, no forest products may be gathered or removed without written authority. The only exception to this rule is made in the exercise of rights of usage of fuel, tapping, and gathering of mast. Trees may be felled only after they have been marked by the forest service, and felling must be done according to the directions and under the supervision of agents, who are required to do the marking themselves, even in private forests.

Exercise of rights of usage, especially that of fuel gathering, has been a fruitful source of abuses, and is responsible to a great extent for the low production of the state forests. Any villager may gather fuel for domestic use in the state forests entirely free of cost, and the same practice is also general in nearly all the private forests.

Tapping for resin is common in most of the forests of Aleppo pine, especially in the warmer regions of southern Greece, where the resin flows more abundantly than in the north. This practice was formerly carried on to supply resin for the resin wine commonly used in Greece, but during the last twenty years industrial turpentining has become more and more general. In many parts of the country the inhabitants still exercise a very ancient right of usage which allows them to tap trees without special authorization, though with certain restrictions, including payment of a tax.

Another right of usage commonly practiced in the state forests is that of gathering the acorn cups of Valonia oak (*Quercus aegilops*), which are very rich in tannin. The acorns may be gathered free in nearly all state forests after August 10, and the privilege is limited only by payment of a tax.

Grazing is generally allowed in state forests, no limit being placed on the number of animals. The forest service has the right, however, to limit this practice in places where regeneration of the forest is endangered. Abuse of the right is another prolific cause of destruction in many forests, and frequently proves a serious obstacle to natural reproduction.

Education.—There is a forest school at Athens for training higher forest officers. In addition, there are two forest schools for rangers, and before the war scholarships were awarded to a certain number of individuals, who visited Austria for the purpose of studying forestry in that country.

The new law passed in 1918 for the reorganization of the forest personnel makes the problem of filling the vacancies very acute. Under this law the personnel will consist at first of 20 inspectors, 50 chief rangers, 120 district inspectors, 150 rangers, and 850 guards. The staff will be recruited as much as possible from the ranger schools. In order to fill the large number of vacancies which already exist the law provides for the employment of returned soldiers, preference being given to non-commissioned officers, who will be called "probationers" and who will not receive promotion until they have taken a course at the ranger school. A measure of this kind is not practicable as far as the higher officials are concerned, and it will be some years before the forest school at Athens will be able to graduate enough men to equip the forest service properly.

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HUNGARY

Forest Area.—The forest area of Hungary prior to the war was over 22,000,000 acres. According to recent estimates barely one-seventh of this remains to Hungary as she now is—approximately 3,148,000 acres. This constitutes 14 per cent of the land area and 0.4 of an acre per inhabitant. Most of the forests of Hungary extended along the Carpathians and their spurs, and between the rivers Save and Drave; hence nearly all of the forest area of the country was transferred to Rumania by the terms of the peace treaty. The new state of Hungary is chiefly a plains country.

Character of the Forest.—Even before the war hardwoods predominated in Hungary. The principal species were beech and oak. Now that the mountain ranges are eliminated the proportion of hardwoods is even greater than before. The lowland forests are mainly of poplar, willow, oak, locust, and beech. It may be safely assumed that 95 per cent of all the forests today are hardwoods and only 5 per cent conifers.

Character of Ownership.—Before the war Hungary was a country in which private ownership greatly predominated. It is even more so today. In pre-war Hungary the state forests proper did not form more than about 12 per cent of the total forest area, while all the public forests, including state, communal, and church forests, constituted about 30 per cent.

Annual Growth.—The annual yield per acre in pre-war Hungary was on an average about 44 cubic feet. The annual yield per acre of coniferous forest was estimated at 58½ cubic feet; that of oak forest 41½ cubic feet and of all other forests 40 cubic feet. Since Hungary lost most of her coniferous forest, the average yield per acre now is probably closer to 40 than to 44 cubic feet. This for an area of 3,148,000 acres makes an annual growth of nearly 126,000,000 cubic feet.

Annual Cut.—The cut per acre in the state forests of Hungary before the war was about 30 to 33 cubic feet per year. The great drawback of the Hungarian forests, however, was always the small percentage of sawlog material. Thus even in the state forests the yield of the different grades of wood was as follows:

	Per cent
Oak:	
Sawlog	25 to 40
Cordwood, wood for charcoal	75 to 60
Beech:	
Sawlog	3 to 15
Cordwood, wood for charcoal	97 to 85
Conifers:	
Sawlog	70 to 85
Cordwood, wood for charcoal	30 to 15

Since practically all the forests of Hungary today are hardwoods, largely beech, the percentage of sawlog timber must be very low. Even assuming that it is 15 per cent of the total annual growth, it forms but 19,000,000 cubic feet.

Domestic Consumption.—Assuming that the cut per acre is still about 30 cubic feet, as it was before the war, the total annual cut must be in the neighborhood of 94,500,000 cubic feet, or 12.0 cubic feet per capita, a rather small consumption. Considering, however, that only 15 per cent of that, or 14,200,000 cubic feet, is sawlog material, the consumption of construction and industrial timber per inhabitant is less than 2.0 cubic feet. Instead of exporting timber as Hungary did before the war she will now have to import it.

Wood-Using Industries.—The timber and allied industries of Hungary are of course proportionately diminished. For instance, at the beginning of the war Austria-Hungary had 112 paper mills, with 254 machines. Now Czechoslovakia has 58 mills, producing 226,070 tons, Austria has 40 mills, producing 153,000 tons, and Hungary 1 mill, producing 3,460 tons. The greater part of the wood-using industries remain Hungarian, particularly the furniture, parquet-flooring, and cask-making factories; but both raw materials and market have been lost, and Hungary will have to import timber for her mines and other industries from the border states, which have acquired numerous sawmills together with the forests.

Czechoslovakia, Poland, Rumania, and Jugo-slavia will all have a share in supplying the timber market of Hungary.

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ITALY

Forest Area.—At the beginning of the war Italy had a forest area of about 11,250,000 acres, representing 15.9 per cent of the total land area of the country, or 0.31 acre of forest to every head of population. If only the productive land area is considered, the percentage under forest is somewhat higher, namely, 17.3. These figures include, however, the chestnut groves (castagneti) which in the aggregate amount to 1,610,000 acres. The chestnut groves, although of enormous value and capable of bringing large revenue, are only of very limited importance as timber producers. Without them the total forest area amounts to only 9,640,000 acres. The largest areas of chestnut groves are in the provinces of Tuscany, 405,010 acres; Piedmont, 265,720 acres; Liguria, 241,390 acres; Calabria, 224,300 acres, and Emilia, 131,400 acres. The amount of chestnuts gathered in Italy in 1919 was 1,549,833,800 pounds; in 1910, 1,339,316,546 pounds; and in 1911, 1,443,351,620 pounds.

The land surface of Italy consists of mountains, hills, and valleys. Therefore the forests also fall, according to their topographic location, into mountain forests, hill forests, and plains forests.

The mountain forests occupy an area of about 6,425,000 acres, or

57 per cent of the entire forest area; the hill forests 4,074,000 acres, or 36 per cent, and the forests of the plains 749,000 acres, or only 7 per cent. The distribution of the forests in the mountains, hills, and plains, as well as the percentage of land under forest in each province, is given in Table 104.

TABLE 104.—ITALY—ALTITUDINAL DISTRIBUTION OF FORESTS WITHIN PROVINCES

Provinces	Total land area of each province	Forest area in mountain region	Forest area in hill region	Forest area in plains	Total forest area	Per cent of land area
	acres	*acres*	*acres*	*acres*	*acres*	
Piedmont	7,260,856	968,102	429,037	92,022	1,489,161	20.5
Liguria	1,307,675	552,341	33,854	....	586,195	44.8
Lombardy	5,950,168	604,382	212,961	136,156	953,499	16.0
Venice	6,074,797	480,963	161,402	51,650	694,015	11.4
Emilia	5,150,602	503,487	138,807	31,233	673,527	13.1
Tuscany	5,950,331	802,152	1,154,103	186,463	2,142,718	36.0
Marches	2,393,647	224,916	21,877	....	246,793	10.3
Umbria	2,412,484	326,472	236,641	....	563,113	23.3
Rome (Latium)	2,984,432	119,830	278,846	114,136	512,812	17.2
Abruzzi-Molise	4,085,259	582,796	26,859	....	609,655	14.9
Campania	4,015,025	309,903	368,104	66,806	744,813	18.6
Apulia	4,718,730	....	162,647	14,202	176,849	3.7
Basilicate	2,466,829	409,867	55,533	11,369	476,769	19.3
Calabria	3,727,509	307,601	547,357	....	854,958	22.9
Sicily	6,357,293	169,563	64,751	1,692	236,006	3.7
Sardinia	5,954,871	62,842	180,915	43,030	286,787	4.8
Total	70,810,508	6,425,217	4,073,694	748,759	11,247,670	15.9
Per cent of forest area	....	57.1	36.2	6.7	100	

The largest areas of mountain forests are in the provinces of Piedmont, Tuscany, Abruzzi, Lombardy, Liguria, and Emilia. As for the percentage of land under forest, the most forested are the provinces of Liguria and Tuscany (above 35 per cent), and the least forested Apulia and the islands of Sicily and Sardinia (less than 5 per cent).

Since the bulk of the forests is in the mountains, they are not only difficult of access, but must serve as a protection against erosion, hence great care must be observed in cutting the timber on mountain slopes. For this reason the productivity of the mountain forests is low.

Under the terms of the Rapallo Treaty the forest area has been increased through the addition of new territories by 3,002,000 acres, distributed as follows:

Territories	Forest area	Proportion of forest to total productive area
	acres	*per cent*
Trentino	781,000	54
Alto Adige	699,000	47
Gorizia	167,000	26
Trieste	6,000	26
Istria	406,000	34
Dalmatia	943,000	30
Total	3,002,000	38

This area, added to the pre-war area of 11,250,000 acres, gives a present total forest area of 14,252,000 acres, or 18.1 per cent of the total land area, and a per capita forest area of 0.37 acre.

The forest area of Italy has undergone a considerable decrease within the last 40 years. According to statistics of 1870 the area of all forests then amounted to 12,414,000 acres, or 17.6 per cent of the total land area. In 1911 the forest area had decreased to 11,272,376 acres, and the percentage of land under forest had dropped to 15.9. The present tendency on the part of the government is to increase the forest area by purchasing and restocking denuded lands. Thus by 1914 there had been purchased 28,361 acres, at a cost of $207,626. Recently there has been purchased in the Apennines a forest area of 14,457 acres, valued at $434,250, and several other areas are under consideration. In Italy land in general, including forest land, has a high value, and all such purchases cost the government large sums of money; but the government, in following out the national policy, does not stop at large expenditures.

Character of the Forest.—There are no recent figures as to the distribution of the forests by species. The only data available are those of 1870. The relation between the different species, however, has not changed materially. Of the total forest area 89 per cent, or 10,011,000 acres, is occupied by broadleaf species; 6.9 per cent, or 776,000 acres, by mixed broadleaf and coniferous species, and 4.1 per cent, or 461,000 acres, by coniferous species alone. The outstanding fact with regard to the distribution of species in the Italian forests is the enormous predominance of broadleaf forests. This explains the great deficiency of construction material, which Italy is compelled to obtain from other countries.

Compared with other European countries the forests are characterized by a large number of species. Among the coniferous species which have economic importance is fir (*Abies pectinata*), "Abete bianco," widely distributed in the foothills of the mountains. In the Apennines fir extends as high as 5,900 feet above sea level, and in Sicily often up to 6,400 feet, practically to timberline. Spruce (*Picea excelsa*) is also confined almost entirely to mountain slopes. Pine is represented by a large number of species. The common pine (*Pinus sylvestris*) enters to a large extent into the composition of the forests of northern Italy. In the Apennines it extends as high as 5,250 feet. Mountain pine (*Pinus montana*) is most frequently found in the Abruzzi Mountains, where it occupies a belt from 1,000 to 9,000 feet in width. Black pine (*Pinus laricio*) is common chiefly in the Abruzzi Mountains and in southern Italy. On the west coast occur *Pinus pinaster* and *Pinus halepensis;* in Calabria, *Pinus brutia* or Calabrian pine; and in many places, for instance in Liguria, in the provinces bordering upon the Adriatic, and also in Sardinia, Aleppo pine and the famous Italian pine (*Pinus pinea*). In addition, maritime pine (*Pinus maritima*), American white pine (*Pinus strobus*), and several others, occur in plantations. Larch (*Larix europaea*) is found chiefly in the mountain forests of northern and central Italy, often associated with "cedar" (*Pinus cembra*). A common species, especially in the south of Italy and also on the islands of Sicily and Sardinia, is yew. which occasionally attains a fairly large size.

Of the broadleaf species the most common tree in the Italian forests is beech (*Fagus sylvatica*), which occurs over the entire country, including Sicily. In the mountains the upper limit of its distribution is at 6,200 feet (in the Apennines), and on Etna it occurs even at a height of 7,000 feet. A more valuable tree, although less common than beech, is oak, which is represented by several species. Among these the more important are *Quercus pedunculata, Quercus sessiliflora,* and in southern Italy *Q. cerris.* Cork oak (*Q. suber*) also forms large forests. Under proper handling cork oak yields from 357 to 446 pounds per acre. This at 4.4 cents per pound represents a yield of \$15.71 to \$19.62 per acre. The total annual production of cork in Italy within recent years reached 5,000 tons.[1]

Another important hardwood tree—but largely because of its edible fruit—is chestnut (*Castanea vesca*). Among other hardwoods which have some importance in forestry may be mentioned hornbeam (*Carpinus betulus* and *C. duinensis*) and birch (*Betula verrucosa*), which occur also in Sicily, alder (*Alnus glutinosa*), several species of elm (*Ulmus campestris, U. Montana,* and *U. effusa*), maple (*Acer pseudoplatanus, A.*

[1] This is a comparatively small amount considering that Portugal produces annually 80,000 tons, Spain 80,000 tons, France and Algeria 51,000 tons, and Tunisia 4,000 tons.

platanoides, A. italum, A. campestre, A. monspessulanum and *A. negundo*), linden (*Tilia parvifolia* and *T. grandifolia*), ash (*Fraxinus excelsior* and *F. ornus*), many species of poplar, the most common tree of Italy, such as *Populus alba, P. nigra* and *P. pyramidalis,* walnut (*Juglans regia* and *J. nigra*), locust, and a great many willows.

The forests of Italy may be divided into three main zones:

1. The coastal or evergreen zone
2. The mountainous zone
3. The alpine zone

The coastal or evergreen zone is characterized by the presence of a large number of evergreen broadleaf species and only a small number of timber species as they occur in the mountains. Geographically, this zone includes the entire coastal region of Italy on both the Mediterranean and Adriatic sides, and extends vertically up to between 2,200 and 2,600 feet, that is, up to the upper limit of distribution of olive trees.

The mountainous forest zone includes the most valuable forests of both broadleaf and coniferous species. The lower limit of this zone coincides with the upper limit of olive trees. The lower extension of this zone is characterized by chestnut and the upper by beech.

The alpine zone is made up of two belts. The lower, or sub-alpine, is the belt of coniferous forests and the alpine is the belt of alpine meadows.

The distribution of commercial forests in Italy may be briefly summarized as follows:

In the Italian Alps in the northern part of Italy the forests occupy about 2,470,000 acres. The principal species composing these forests are: pine, spruce, fir, and larch, of the conifers; beech, oak, maple, ash, linden, alder, and chestnut, of the hardwoods. The forests in this region are for the most part mixed, and occur in small areas on the slopes of the mountains. In the northern and central Apennines hardwoods predominate, particularly beech, several species of oak, chestnut, hornbeam, locust, and poplar. Conifers are represented by pine, spruce, and fir, which occur principally at high altitudes. Finally, in the southern extension of the Apennines the principal hardwood species are beech and oak. Conifers occur only in the mountain regions of Catanzaro and Reggio. On the whole, the forest area of the region of the Apennine Mountains is estimated at 4,446,000 acres. In the plains and foothills of Italy the forest area, chiefly hardwoods, with a large amount of chestnut groves, aggregates 2,964,000 acres. Finally, the large Italian islands, Sicily and Sardinia, are very little forested. In Sardinia, forests occur only in the mountain districts of Sassari and Cagliari. The principal hardwood species are chestnut, walnut, and alder, while yew is the

Table 105.—Principal Species of Italy with Their English and Italian Common Names

Fir	Abies pectinata	Abete, Abete bianco
Larch	Larix europaea	Larice
Spruce	Picea excelsa	Abete rosso, Pezzo
Pine	Pinus sylvestris	Pino bianco, Pino silvestre
Pine	Pinus halepensis	Pino d'Aleppo, Pino di Gerusalemme
Pine	Pinus maritima	Pino marittimo
Pine	Pinus laricio	Pino laricio, Squaro di Corsica
Pine	Pinus brutia	Pino calabrese
Pine	Pinus montana	Pino montana, Pino Mugo
Pine	Pinus pinaster	Pino salvatico, Pino marittimo
Pine	Pinus austriaca	Pino nero
Pine	Pinus pinea	Pino domestico, Pino da pinocchi
Pine	Pinus cembra	Pino cembro
Oak	Quercus pedunculata	Farnia, Quercia
Oak	Quercus sessiliflora	Rovere
Oak	Quercus suber	Sughera
Oak	Quercus aegilops	Vallonea
Oak	Quercus cerris	Cerro
Oak	Quercus conferta	Farnetto
Oak	Quercus macedonica	Fragna
Oak	Quercus ilex	Leccio
Oak	Quercus occidentalis	Sughera occidentale
Ash	Fraxinus excelsior	Frassine
Ash	Fraxinus ornus	Orinello, Avorniello
Alder	Alnus glutinosa	Ontano nero
Alder	Alnus cordata	Ontano napolitano
Alder	Alnus incana	Ontano bianco
Birch	Betula alba, verrucosa	Betulla
Aspen	Populus tremula	Albera, Tremolo
Blue beech	Carpinus betulus	Carpine bianco
Chestnut	Castanea vesca	Castagno
Beech	Fagus sylvatica	Faggio
Maple	Acer campestre	Testucchio
Maple	Acer italum	Oppio, Loppo
Maple	Acer monspessulanum	Acero minore
Maple	Acer platanoides	Acero riccio
Maple	Acer pseudoplatanus	Acero montano, Acero sicomoro, Acero Fico
	Ceratonia siliqua	Carrubio
Hackberry	Celtis australis	Bagolaro, Spaccasassi
Redbud	Cercis siliquastrum	Albero di Giuda
Cypress	Cupressus sempervirens	Cipresso
Hornbeam	Ostrya carpinifolia	Carpine nero
Pistachio	Pistacia lentiscus	Lentisco
Pistachio	Pistacia terebinthus	Scornabecco
Cherry	Prunus avium	Ciliegio salvatico
Locust	Robinia pseudacacia	Acacia, Gaggaia
Willow	Salix caprea	Salica, Salicone
Mountain ash	Sorbus aucuparia	Sorbo da uccellatori

Table 105.—Principal Species of Italy with Their English and Italian Common Names—*Continued*

Mountain ash	Sorbus aria	Matallo
Mountain ash	Sorbus domestica	Sorbo domestico
Mountain ash	Sorbus torminalis	Ciavardello
Basswood	Tilia grandifolia	Tiglio a foglie grandi
Basswood	Tilia parvifolia	Tiglio a foglie piccole
Elm	Ulmus campestris	Olmo
Elm	Ulmus montana	Olmo montano
Elm	Ulmus effusa	Olmo montano
Poplar	Populus alba	Pioppo
Poplar	Populus nigra	Pioppo albaro, albero
Poplar	Populus pyramidalis	Pioppo

principal conifer. In the hilly part of the island are found oak, chestnut, locust, and frequently Aleppo pine.

The principal species of Italy with their English and Italian common names, are given in Table 105.

Character of Ownership.—According to ownership the forest area is distributed as follows:

Ownership	Acres	Per cent
Government forests	427,500	3.8
Villages, municipalities, and corporations	4,860,000	43.2
Private forests	5,962,500	53.0

Most of the forests of the lower hills and plains regions are private, while those of the mountains are owned by the state, communes, or other public entities or corporations. The government forests are of two kinds: those which come under the jurisdiction of the Treasury Department and those which come under the supervision of the Department of Agriculture. The forests in charge of the Treasury Department, which comprise some 280,000 acres, are subject to sale by the government to private individuals. Those under the Department of Agriculture, recently increased by purchase to about 148,200 acres, are the true state forests which under the law cannot be alienated. The largest individual state forests lie in Tuscany (27,906 acres) and in Venice (two forests with 15,944 and 14,662 acres, respectively). The state forests under the supervision of the Department of Agriculture thus form only 1.3 per cent of the entire forest area. Italy therefore must be classed among the countries which have a very small area of state-owned forests. Small private ownership predominates.

Ownership in the newly acquired territories is distributed as follows:

Ownership	Acres	Per cent
State	85,000	2.8
Communes, etc	1,563,000	52.1
Societies	105,000	3.5
Church foundations	42,000	1.4
Private	1,207,000	40.2
Total	3,002,000	100.0

Annual Growth.—There are no reliable statistics as to the amount of wood grown annually in the forests of Italy. It is a well-known fact, however, that the productivity of the Italian forests is very low. This is due not merely to poor management but also to the fact that the forests are for the most part sprout hardwoods, producing chiefly firewood. Areas of large-size timber are found here and there but are few in number. The average annual increment for all forests is estimated at 30 cubic feet per acre, including both sawlog and firewood material. The increment of sawlog material is not more than 3.7 cubic feet per acre per year, or about one-eighth of the total wood production. At this rate the increment for the entire forest area may be accepted as 337,500,000 cubic feet of all classes of wood. The increment of sawlog material alone is 41,625,000 cubic feet. The increment of coniferous sawlog material is only about one-third of the cut of such material.

The increment in the forests of the newly acquired territories, Trentino, Alto Adige, Gorizia, Trieste, Istria, and Dalmatia, is placed at 75,722,000 cubic feet, of which 30 per cent, or 22,716,000 cubic feet, is timber and about 53,000,000 is fuelwood. More detailed figures for the newly acquired territories are given in Table 106.

The annual growth for the entire present forest area of Italy, therefore, may be estimated as 413,222,000 cubic feet, or 29.0 cubic feet per acre. The increment of sawlog material is 64,341,000 cubic feet, or 4.5 cubic feet per acre.

Annual Cut.—The average annual cut before the war amounted to about 50 million cubic feet of sawlog material and 335,350,000 cubic feet of fuelwood, or a total of 385,350,000 cubic feet. This represents an average annual cut of 34.2 cubic feet per acre, and of sawlog material

TABLE 106.—ITALY—AVERAGE ANNUAL GROWTH IN THE FORESTS OF THE NEWLY ACQUIRED TERRITORIES

Territories	High forest				Standards with coppice				Simple coppice				Total			
	Per acre	Total	Timber	Fuel	Per acre	Total	Timber	Fuel	Per acre	Total	Timber	Fuel	Per acre	Total	Timber	Fuel
	cu. ft.	*cu. ft.*	*per cent*	*per cent*	*cu. ft.*	*cu. ft.*	*per cent*	*per cent*	*cu. ft.*	*cu. ft.*	*per cent*	*per cent*	*cu. ft.*	*cu. ft.*	*per cent*	*per cent*
1. Trentino..	31.5	14,357,357	57	43	40.0	2,426,487	41	59	27.2	7,252,067	3	97	30.0	24,035,911	39	61
2. Alto Adige.	24.3	15,983,593	58	42	......	....	....	....	37.2	1,234,900	16	84	24.3	17,218,493	55	45
3. Gorizia....	27.2	1,520,194	47	53	32.9	2,890,293	15	85	31.5	893,726	4	96	31.5	5,304,213	21	79
4. Trieste ...	22.9	25,416	25	75	25.7	22,239	15	85	27.2	95,769	10	90	25.7	143,424	14	86
5. Istria.....	30.0	1,554,330	22	78	31.5	1,176,478	19	81	24.3	7,953,549	3	97	25.7	10,684,357	9	91
6. Dalmatia..	22.9	1,420,931	35	65	20.0	1,205,672	18	82	18.6	15,708,394	6	94	18.6	18,334,997	9	91
Total..	27.2	34,861,821	55	45	31.5	7,721,169	24	76	22.9	33,138,405	5	95	25.7	75,721,395	30	70

alone 4.4 cubic feet per acre. Of the 50 million cubic feet of sawlog material cut only 14,120,000 cubic feet was softwoods.

The cut in the newly acquired territories amounts to about 75,722,000 cubic feet, of which 22,716,000 cubic feet is sawtimber and 53,006,000 is fuelwood. The cut for entire Italy is now 461,072,000 cubic feet, or 32.4 cubic feet per acre. Of this, 27.2 cubic feet is fuelwood and 5.1 cubic feet sawtimber.

While the cut of firewood exceeds the increment of firewood by about 39,000,000 cubic feet, the cut of sawlog material, small as it is, still exceeds the growth of such material by 8,375,000 cubic feet a year. Italy thus continues to cause deterioration of her forests by cutting large-sized timber in excess of its production.

Domestic Consumption.—Before the war Italy consumed annually 127,080,000 cubic feet of softwoods and about 56,480,000 cubic feet of hardwoods, or in all 183,560,000 cubic feet of sawlog material. In addition, it used about 335,350,000 cubic feet of fuelwood, making the total domestic consumption about 519,000,000 cubic feet. At a population of about 36,000,000 the per capita consumption is in the neighborhood of 14.2 cubic feet. Of the 519,000,000 cubic feet consumed annually, 335,350,000 cubic feet of fuelwood was produced at home and 134,000,000 cubic feet of sawlog material was imported from other countries. The home production of sawlog material was only a trifle more than one-fourth of the country's requirement.

Imports and Exports.—Italy imports on the average 134,000,000 cubic feet, or about three-fourths of the country's requirements for construction material. This dependence upon timber importations becomes even more striking if the requirements for softwoods alone are considered. While the annual consumption of softwood timber is 127,080,000 cubic feet, the home production of softwoods is not more than 14,120,000 cubic feet, or one-ninth of the total requirement. In other words, 112,960,000 cubic feet was, under normal conditions, imported from abroad. Of this, 98,840,000 cubic feet imported annually before the war was softwood lumber and about 14,120,000 cubic feet coniferous pulpwood.

The situation is better with regard to hardwoods, as the home supplies of hardwoods are much more plentiful. Of a total annual consumption of 56,480,000 cubic feet of hardwoods, only 21,180,000 cubic feet was imported from abroad and 35,300,000 cubic feet was produced within the country. A total home production of even 49,420,000 cubic feet a year, in the opinion of the Italian foresters, exceeded the normal capacity of the forests, i.e., even at such a rate of cutting the forests were overcut. Such was the situation before the war.

The imports of common, rough, round, or hewn timber and sawn lumber in 1913, a good representative pre-war year, are shown in Table 107.

TABLE 107.—IMPORTS INTO ITALY

Quality	Volume	Per cent	
	cu. ft.		
Common rough, round, or hewn timber	12,213,800		10.06
soft resinous	7,074,120	7.02	
hard resinous	1,397,880		
common hard broadleaf	2,287,440	3.04	
high-grade hard broadleaf	889,560		
soft broadleaf	564,800		
Common sawed lumber	107,552,040		89.94
soft resinous	75,139,580	75.32	
hard resinous	14,931,900		
common hard broadleaf	8,641,440	14.62	
high-grade hard broadleaf	8,754,400		
soft broadleaf	84,720		
Total	119,765,840	100.00	

To this must be added 14,120,000 cubic feet of pulpwood, making a total of 133,885,840 cubic feet.

Italian imports therefore consist of about 90 per cent of sawed lumber and 10 per cent rough, round, and hewn timber. By species, resinous sawed lumber constitutes 75 per cent of all the imports and hardwoods about 15 per cent. Softwood round and hewn timber forms 7 per cent and hardwoods 3 per cent. The imports of lumber and forest products into Italy increased 230.7 per cent between 1888 and 1911. In value the imports of lumber and hewn timber amounted to about $27,000,000, and the imports of pulp to $5,700,000. On the whole, imports of forest products form a rather small per cent of the value of all imports. On an average for the three years before the European war the value of forest products imported was about 4.8 per cent of all the imports. During the war it fell off to 1½ per cent. The value of pulp and paper imports before the war was less than 1 per cent of the total. The importance of the import, however, must be judged by quantity rather than by value. The amount of principal forest products imported into Italy during the three years from 1912 to 1914 was on an average about 1,420,000 tons. During the same period the average import of pulp and paper amounted to 110,230 tons.

The part which the different countries took in supplying Italy with forest products is shown in Table 108.

Table 108.—Imports of Timber, Pulp, and Paper, by Countries of Origin

Import of Timber

Country of origin	1912	1913	1914	1915
Total wood import (value)	$28,058,533	$27,045,090	$24,083,505	$7,781,953
From:				
Austria-Hungary:				
Value	$21,897,000	$20,168,500	$17,735,928	$1,914,174
Per cent	78.4	74.6	73.7	24.3
North America:				
Value	$ 3,553,709	$ 4,123,059	$ 3,710,425	$2,170,478
Per cent	12.7	15.2	15.4	27.8
Scandinavian countries:				
Value	$ 140,311	$ 100,746	$ 123,906	$ 183,157
Per cent	0.5	0.4	0.5	2.4
Germany:				
Value	$ 446,409	$ 479,412	$ 292,588	$ 290,079
Per cent	1.6	1.8	1.2	3.6

Import of Pulp and Paper

	1912	1913	1914	1915
Total import of pulp and paper (value)	$5,333,748	$5,711,642	$5,429,090	$5,080,918
From:				
Austria-Hungary:				
Value	$2,154,459	$2,405,359	$2,585,621	$ 909,995
Per cent	40.4	42.1	47.6	17.9
North America:				
Value	$ 14,475	$ 27,213	$ 6,948	$ 9,843
Per cent	0.3	0.5	0.1	0.2
Scandinavian countries:				
Value	$ 738,997	$ 927,558	$ 775,474	$3,104,212
Per cent	13.8	16.2	14.3	61.1
Germany:				
Value	$2,027,910	$2,035,571	$1,760,739	$ 852,288
Per cent	39.3	35.6	32.4	16.8

Before the war Austria played the predominant part in supplying Italy with forest products. Thus on the average for the three years from 1912 to 1914 Austria-Hungary furnished over 75 per cent in value of all the timber imported by Italy. Its vast forest areas, its proximity to Italy, and its convenient water and railroad means of communication made Austria-Hungary the natural and principal provider of timber for Italy. It had well-developed lumber and wood-using industries and an effective organization for export trade. It was the most serious competitor of other countries importing timber into Italy. Although Austria-Hungary no longer exists as a political unit, the region will continue to be the principal exporter of forest products into Italy. Austria-Hungary exported into Italy chiefly sawn lumber of coniferous species, and also roughly hewn timber.

Next to Austria-Hungary in extent of exports to Italy was the United States. For the three years 1912 to 1914 the United States furnished about 15 per cent in value of all the timber imported and showed a tendency to increase the amount. The United States sent chiefly sawed and hewn lumber. Of other exporting countries should be mentioned Germany and Scandinavia. The value of imports for this period averaged 1½ per cent from Germany and from Scandinavia only 0.5 per cent. The timber imported from Germany, however, was of Russian origin.

As regards imports of pulp and paper the situation is somewhat different. The first place was again occupied by Austria-Hungary, from which imports of pulp and paper for the three years 1912, 1913, and 1914 averaged about 43 per cent of all such imports. The second place, however, was occupied not by the United States but by Germany, which furnished on an average for that period 36 per cent of the entire imports of paper and pulp commodities. Scandinavia was also represented to the extent of 15 per cent.

The chief ports of Italy which receive timber are Genoa and Naples. Other ports, however, also played an important part. The extent of the imports at the different ports may be gauged by the following figures:

Table 109.—Value of Imported Timber by Ports

Port	1912	1913	1914
Genoa	$3,493,300	$3,706,758	$3,551,007
Leghorn	302,624	187,210	67,743
Naples	1,666,362	1,244,078	1,030,813
Ancona	279,850	357,629	236,039
Venice	945,507	838,392	646,743
Messina	666,429	964,807	848,042
Catania	923,891	956,701	860,780
Cagliari	312,853	268,077	241,636

Wood-Using Industries.—The lumber and other wood-using industries of Italy are still undeveloped. Indeed, in view of the poor condition of the forests and their low productivity, the development of a home lumber industry of any importance is out of the question. The methods of manufacture are generally primitive, a great amount of the work being done by hand labor. There are only 210 sawmills in the country, most of them small. The larger mills are located in the northern part of Italy.

There are many small wood-using and carpentry shops in the larger cities, most of which have band saws. These shops put out all kinds of interior woodwork, such as doors, paneling, railing, stairs, mantels, etc. The woods used for manufactures of this kind are Baltic pine, Austrian spruce, silver fir, yellow pine from America, and for higher grade work Italian walnut, mahogany, and Slavonian oak.

One of the chief wood-using industries of Italy is the manufacture of railway, street, and freight cars. Before the war there were in Italy 36 establishments of this kind, some of which put out as many as 2,600 cars annually. The lumber chiefly used for this purpose is American yellow pine—about 75 per cent. Other woods used are Italian walnut, ash, teak, and oak.

Shipbuilding offers a very promising field for development, owing to the geographical location of Italy on the Mediterranean. Most of the larger ships from now on will be made of steel, but lumber will be needed for frame timbers and interior finishing.

A very important wood-using industry is the manufacture of boxes and crates of all kinds for packing the fruits which are shipped in enormous quantities from Italy and Sicily. The number of boxes required annually for lemons alone in Italy is estimated at 11 to 14 million. There are over 500 box-making factories in Sicily. The kinds of wood generally used for boxes are Italian pine, beech from southern Italy, spruce from Switzerland, and silver fir; but the growing shortage of material is compelling the factories to make use of almost any kind of lumber they can get.

Furniture making is one of the chief industries of Italy, which ranks among the leading nations of Europe in this respect. Much of the furniture is of high grade and is made from Italian walnut, a highly esteemed cabinet wood, mahogany, and other tropical woods. Medium quality and cheap furniture are made from American woods—red gum, southern yellow pine, and oak—and from Austrian beech and spruce and Italian chestnut and pine. Italy manufactures a large amount of "period" or imitation antique furniture, often beautifully designed and ornamented with carving and inlaid work.

Considerable quantities of parquetry flooring are manufactured in Italy, most of which is exported to South America. Woods used for the purpose are yellow pine, white oak, maple, cherry, American oak, and Douglas fir.

Mining industries consume under normal conditions about 3,106,400 cubic feet of timber per year. The principal woods employed are oak, larch, pine, poplar, chestnut, elm, acacia, and beech.

An important industry is the manufacture of musical instruments, especially violins, mandolins, and guitars. The normal annual output of these instruments is estimated at 300,000 and they are exported to many countries. The wood used for this work must be only the best grade of clear stock. The preferred wood for sounding boards is Austrian spruce, which has resonant properties. Other parts of the instruments are made of poplar, basswood, pine, ash, Italian walnut, mahogany, and rosewood.

The pulp and paper industry is developed on a fairly large scale. In 1913 there were 20 pulp plants and 462 paper plants, employing in all 25,000 persons. Among the paper plants were included a large number of small plants which manufactured pasteboard.

Minor wood-using industries are the manufacture of patterns and flasks, woodenware, toys and novelties, trunks, spars, and masts. Wood carving is an interesting and widespread industry, large amounts of fine carved woodwork being used in churches and cathedrals, and in important public buildings of all kinds.

The state railways consume normally about 3,000,000 ties per year, of which about 250,000 are imported. These are cut from white and red oak, beech, pine, elm, and eucalyptus. Since there is a serious shortage of tie material in the forests of Italy, a large share will have to be imported.

The match industry also plays a considerable part among the wood-using industries. In 1912 there were 151 match-producing factories, which turned out 64,288 million matches. The veneer industry is little developed. In 1913 there were only four veneer factories.

With a low forest productivity and undeveloped wood-using industries at home, Italy must meet the needs for wooden commodities by importations from abroad.

Forest Laws.—The evil consequences of extensive cutting and grazing in the forests, especially in the mountain regions, attracted the attention of the Italian governments even before the unification of the Italian kingdom. It was only in 1877, however, that a law was passed which limited the rights of private owners in the free use of the forests. For purposes of this law the forests were classified into protective and non-protective forests. In 1877 the first forest protective committees were organized. Their function was to look after cutting and grazing in forests recognized as protective forests as well as to issue permits for clearing forest lands for agricultural use under certain conditions. These committees were also charged with reforestation of denuded areas within the protective zones. The area over which the law was operative amounted to 10,339,479 acres in 1908, while the area of the forests to which the law of 1877 was not applicable amounted to 4,445,148 acres. Most of the protective forests are found in the southern Mediterranean and Adriatic provinces, Piedmont, Lombardy, Venice, Marches, and Umbria. Of the 10,339,479 acres which come under the operation of the law of 1877, forests in the true sense occupy only 71.2 per cent, or 7,360,514 acres, the rest is brush land, 10.5 per cent, or 1,084,789 acres, and denuded land, 18.3 per cent, or 1,894,176 acres. Of the 7,360,514 acres in forests, 5,994,614 acres, or 81.4 per cent, are hardwood forests, 1,049,189 acres, or 14.4 per cent, are conifers, and 316,711 acres, or 4.2 percent, are mixed conifers and hardwoods. According to the method of management, 52.2 per cent of the protective forests are classified as high forest, and 47.8 per cent as coppice.

Among the protective measures carried on by the Italian government must be mentioned particularly the reforestation of the mountain slopes. The disastrous effects of deforestation of the mountains in Italy—a country of mountains—are particularly striking. As a result of the deforestation of the mountain slopes large areas in the Alps, Apennines, Abruzzi Mountains, and also in the mountains of Sicily and Sardinia not only become unproductive but constitute an actual menace to the agricultural land in the valleys. Small streams swelled by rain and the thawing of snow into turbulent torrents and no longer retained by forest vegetation rush down with tremendous force and cover agricultural land with sand and stones, causing the owners enormous and often irreparable loss.

A law was enacted in 1910 which made obligatory upon communities and private owners the reforestation of denuded areas in the mountains. The reforestation is done under the direction of the government, and all projects and plans are considered by the Forest Department and must be approved by the Department of Agriculture. On areas where reforestation is not obligatory the government encourages reforestation by giving the owners free seed and planting stock, and also technical supervision, and offers bonuses of from $5 to $10 for each acre reforested. During the period between 1867 to 1900 the work of reforestation progressed very slowly. During that period there were forested only 53,681 acres at an expenditure of $1,116,119. Of this amount $501,800 was spent by the government and $614,319 by communities and private individuals. Between 1900 and 1910, 24,700 acres more were reforested, but actual reforestation on a large scale was undertaken only with the passage of the law of 1910. To carry out the provisions of this law the government appropriated for the first five years about $8,000,000. A large part of this expenditure is for the purchase by the government of forests in the mountains as well as of areas in need of reforestation. The work of the Italian Forest Service is greatly aided by various associations. Particularly active among these is the Italian Touring Club (Touring Club Italiano), which published a series of popular pamphlets acquainting large masses of people with the evils of forest denudation and the need of combating it.

Forest Education.—The aim of forest education is the training of a higher forest personnel and of forest rangers. For the training of foresters of the higher grade there is a National Forest Institute at Florence. Only those who have had training in either agriculture or engineering are admitted to this Institute. It is located in one of the old palaces of Florence which served in the past as the residence of the Grand Duke of Tuscany. For the training of forest rangers and the lower forest personnel, there are several forest schools.

Revenue from State Forests.—The gross revenue from state forests (those under the supervision of the Department of Agriculture), during the fiscal year 1911–12 amounted to $190,280. The expenditures for the same year were $113,630, leaving a net revenue of $76,650. The forest expenditures in Italy thus form about 60 per cent of the gross revenue. The average gross revenue per acre in 1911–12 did not exceed $1.34. In 1911 there were 23 state forests, with an average size of between 5,000 and 6,000 acres.

Probable Future.—The forest situation in Italy is summarized in Table 110.

The great deficiency of Italian forests is in timber of sawlog size, particularly of conifers. The war, with its excessive demands for timber at a time when only a comparatively small part could be imported from abroad, further depleted the limited supply of conifers in Italy. Cutting in those forests during the war doubled and even trebled. The Italian foresters feel that if the demands of the next few years for timber are to be met by cutting of native timber without large imports from abroad, the Italian forests will be utterly destroyed, especially the coniferous forests.

Italy is thus face to face with the dilemma of either making deeper inroads into her already depleted home supplies, or finding cheap sources of raw material abroad. All the indications are that such sources of timber supply will be found close at home, chiefly around the Adriatic and Black Seas.

First of all, the territories newly added to Italy are fairly well wooded, particularly with coniferous forests, and their normal annual production is close to 22,716,000 cubic feet of sawlog timber, of which 17,500,000 cubic feet is coniferous timber.

In the newly acquired territories the most valuable additions are

TABLE 110.—ITALY—SUMMARY OF FOREST SITUATION

Division	Population	Total land area	Forest area			Cut					
			Total	Per cent	Per capita	Total	Per acre	Fuelwood	Per acre	Sawlog	Per acre
		acres	*acres*		*acres*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Italy before war.	36,546,000	70,810,508	11,250,000	15.9	0.31	385,350,000	34.2	335,350,000	29.8	50,000,000	4.4
New territories..	2,000,000	7,837,619	3,002,000	38.3	1.50	75,722,000	25.2	53,006,000	17.6	22,716,000	7.6
Italy at present..	38,546,000	78,648,127	14,252,000	18.1	0.37	461,072,000	32.3	388,356,000	27.2	72,716,000	5.1

Division	Growth						Excess of cut over growth		
	Total	Per acre	Fuelwood	Per acre	Sawlog	Per acre	Total	Fuelwood	Sawlog
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Italy before war.	337,500,000	30.0	295,875,000	26.3	41,625,000	3.7	47,850,000	39,475,000	8,375,000
New territories..	75,722,000	25.2	53,006,000	17.6	22,716,000	7.6	....	....	....
Italy at present..	413,222,000	29.0	348,881,000	24.5	64,341,000	4.5	47,850,000	39,475,000	8,375,000

Division	Consumption						Excess of consumption over growth		
	Total	Per capita	Fuelwood	Per capita	Sawlog	Per capita	Total	Fuelwood	Sawlog
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Italy before war.	519,350,000	14.2	335,350,000	9.2	184,000,000	5.0	181,850,000	39,475,000	142,375,000
New territories..	75,722,000	37.9	53,006,000	26.5	22,716,000	11.4	....	....	....
Italy at present..	595,072,000	15.5	388,356,000	10.1	206,716,000	5.4	181,850,000	39,475,000	142,375,000

the extensive forests of Trentino and the districts to the north, including the upper valley of the Adige up to the Vetta d'Italia and the Brenner Pass.

The most thickly wooded portions of the new provinces are those drained by the Adige and its three tributaries, the Avisio, the Isarco, and the Rienza, with the basins of the Brenta and the Sarca. The northern portion of these districts is as rich in timber as the southern portion, the Trentino proper. In the Trentino, on account of the differences of soil, the quality of timber varies according to the valley from which it comes. The following is a list of the timber-producing valleys:

Trent district—The Adige valley in the neighborhood of Trent; the valley of the Fresina; and the lower valley of the Aviso, better known as the Val Cembra.

Mezzolombardo district—The lower Non valley and the upper basin of Molveno.

Cavalese district—The middle Aviso valley, which includes the Val di Flemme, celebrated for the best quality of spruce.

Primiero district—The upper valley of the Crimson and its tributary, the Vanoi.

Borgo district—The whole of Val Sugana and the valley of the Brenta.

Rovereto district—The valley of the Adige known as Val Lagarina.

Riva district—The lower valley of the Sarca, which flows into Lake Garda and the Valle di Ledro.

Tiona district—The Giudicarie, that is to say the upper Chiese and Sarca valleys.

Cles district—The valley of the Noce or upper Non valley and the Val di Sole.

Trieste, the principal market for Austrian timber and the outlet for the valuable timber trade from Carinthia and Styria, is now an Italian port.

Fiume was the outlet for the timber trade from Croatia and Bosnia, where some of the largest Austrian sawmills are located, and there is no reason to doubt that after conditions become more stable its flourishing timber trade will revive.

This is a considerable addition to the total annual timber production of Italy, particularly as the increase is in coniferous wood, which is the scarcest. Still, with the additional territories the annual timber consumption has also increased and the problem is only partially solved. Some other sources of importation must be found and in larger quantities than in the pre-war period, on account of the greater need of industry and the necessity of allowing the Italian forests to recuperate after the heavy drain of the war.

Before the war softwoods formed more than 80 per cent of the entire import. About 90 per cent of all the imported timber came as sawed timber and about 10 per cent as rough, round, or hewn timber. About 75 per cent of the rough, round, or rough-hewn timber came from Austria, the greater part of it by water or rail. The rest came by sea from the other shore of the Adriatic. Eighty per cent of the sawed timber came from Austria, about 12 per cent from the United States, and the rest from Russia, Rumania, and other countries. A little more than half was shipped by land, almost exclusively from the Venetian frontier. A little less than half came by sea routes, mainly through Genoa and Turin. About seven-ninths of the wood pulp came from Austria-Hungary, Germany, Norway, and other countries. During the last years before the war Germany was surpassing Austria-Hungary in the shipments of wood pulp. About three-fourths of the boards came from the United States and one-fourth from Austria. By species the chief sources of supply were as follows:

Fir	Alps regions of Austria.
Larch	Austria and Switzerland.
Pitch pine	United States (south).
Beech	Bosnia, Croatia, Slavonia.
Walnut	United States.
Oak	Slavonia, Croatia, Bosnia.
Ash	Hungary, Slavonia, Carniola, and Albania.
Maple	Carniola and Croatia.

Thus before the war the countries which formerly made up the Austro-Hungarian empire and now form parts of Jugo-slavia, Rumania, and the other newly created states, and to some extent the United States, were the chief providers of lumber to Italy.

Italy, realizing her dependence upon timber from abroad, was fully alive to the situation even before the war, and tried to meet the problem by acquiring large forest properties or stumpage in Tyrol, Carinthia, Styria, Carniola, Transylvania, and Bosnia. The Italian lumbermen not merely invested in the forest land and stumpage, but actually went into the development of Austrian timber resources, built roads and camps for the workers, and organized the complete process from cutting the wood to sorting the product ready for the market. In this way the Italian industries sought, before the war, to assure themselves of a considerable part of the needed importations. Under normal conditions the needs of the Italian industries would be met by free industrial initiative. Individual initiative in the period of readjustment is unable to cope with the problem, and government assistance is considered essential. Private industry in Italy, as elsewhere, is still in an unsettled state. The foreign countries that supplied most of the Italian wood are disorganized. The conditions of transportation both by water and by rail and the general economic situation of eastern Europe are unstable. The industries therefore need the cooperation of the government in securing the necessary supplies of timber.

From the neutral or allied countries, such as Switzerland, the United States, and Canada, the Italians do not hope to secure much timber. Switzerland during the war was under the necessity of trading timber for food supplies. With its own limited timber supplies it is unable to hold out very much longer, as under normal conditions Switzerland itself imports timber. At present the Swiss Government is under a contract to the Italian Government to supply a small amount of wood. As to timber from the United States and Canada, the Italians feel that the high prices and the low exchange make the purchase of American timber practically out of the question and compel them to look for sources of timber supplies at more reasonable prices and in countries where the rate of exchange is more on a level with their own. The present tendency, therefore, of the Italian industries and Italian Government is to seek a source of timber in the countries lying around the Adriatic and Mediterranean; in other words, in the countries which have recently been separated from Austria-Hungary and also in such countries as Rumania, Ukraine, and the Caucasus. They also feel that the German states of Austria—Tyrol, Styria, Carinthia, and other provinces—from which Italy obtained, before the war, the greater part of her fir timber, should deliver, as a part of the war indemnity for a series of years, a certain quantity of wood, great reserves of which must have accumulated in those provinces during the war because of the stoppage of all export trade. They think that this is very easy of accomplishment as most of the forests are state property over which the government has complete control. Jugo-slavia, which now includes Serbia, Montenegro, Bosnia, Slavonia, Croatia, and Carniola, comprises great forest wealth, of both softwoods and hardwoods. It is a country chiefly agricultural and wooded, which in the natural course of development will be opened up to foreign trade, exchanging forest products for Italian manufactured goods. These forests are also largely public property. In the past, when these countries were parts of Austria-Hungary, the Austrian Government gave extensive forest concessions to the wood industries of Germany and Hungary. It is very probable that the Italian Government can now obtain from the present government of Jugo-slavia similar concessions for the Italian industries on conditions and at prices which private individuals would be unable to obtain. Italian capital is already invested in large amounts in forest properties in those regions, and such concessions would stimulate the Italian lumbermen to resume their development work, which was interrupted by the war.

New sources of cheap timber are also being looked for in Rumania and Russia. Before the war the Italian importations from Rumania and Russia were rather small but were on the increase, plainly indicating the possibility of greater future development. Rumania's absorption of Transylvania made her an important source of timber supply for Italy. Italy is not willing to find herself again in the position in which she was before the war, when she had to depend entirely on Austria-Hungary and the United States for her lumber. The Italian Government therefore is expected to keep close watch over the markets of the Black Sea and the lower Danube, and to investigate thoroughly the less-known forest regions in those sections in order to be ready to take the best possible advantage of them. Albania is also included among the countries which are to be investigated as a possible source of cheap timber.

Briefly, the whole present economic tendency of Italy as far as sources of raw materials are concerned is, in diplomatic language, an orientation toward the east rather than toward the west. Italy no longer expects to secure the bulk of her raw products from the west, but is seeking them in the countries lying to the east, chiefly around the Adriatic and Mediterranean Seas. This may explain the tendency toward an economic "rapprochement" with Jugo-slavia. To carry out this economic policy it is planned to create a special bureau whose functions would be technical and commercial research and general information; this bureau would keep in close touch with the Italian domestic markets and foreign exporting markets, collect and compile statistics, and, through the laboratories of the Royal Forest Institute, make technical tests of the new kinds of timber that the new sources of raw material for Italy may provide.

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JUGO-SLAVIA

With the addition of Bosnia and Herzegovina, Croatia, Slavonia, the Slovenian territory formerly belonging to Austria, the Serbian countries in southern Hungary, the west territory of the Banat known as Vojdodina, part of Bulgaria, and finally Montenegro, the little kingdom of Serbia has grown to a large state known as Jugo-slavia, or the Serb-Croat-Slovene State.[1] It has now an area of about 68,565,760 acres, and a population of about 14,800,000. The land area of Jugo-slavia is thus somewhat larger than that of Great Britain. The exact boundaries of the country are not yet clearly determined. The Jugo-slavian government itself has not had time to take stock of the forest resources that it has acquired. The following figures, therefore, apply only to those areas which are definitely known to belong to Jugo-slavia. The present estimates are based on the statistics available for the territories while they were part of Austria-Hungary.

Forest Area.—The forest area of Jugo-slavia is in the neighborhood of 17¼ million acres, distributed as shown in Table 111.

TABLE 111.—FOREST AREA OF JUGO-SLAVIA

Province	Total forest area	Per cent of land under forest
	acres	
Serbia	3,865,000	31.4
Bosnia and Herzegovina	6,380,000	52.2
Croatia and Slavonia	3,769,000	....
Slovenia	2,544,000	....
Montenegro (estimated)	700,000	30.0
Total	17,258,000	

The forest area as it is known at present is thus 25.2 per cent of the total land area, or 1.2 acres per inhabitant.[2]

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[1] Although Albania is now recognized as an independent state, no attempt has been made to determine its forest area separately. The small size of the country—only a little larger than the State of Vermont—and the vagueness of the new boundaries of Albania and its neighbors—Jugo-slavia, Italy, and Greece—make such an estimate difficult. Furthermore, whatever forests may be credited to Albania—and the country is only sparsely wooded—have probably already been included in the data for the territories of its neighbors of which at one time or another it formed a part.

[2] Since the manuscript was prepared a new estimate of the forest area of Jugo-slavia has become available. According to the latest estimate the total forest area is 18,525,000 acres. This would make the land under forest 27 per cent (*Deutsche Forst-Zeitung, Neudamm*, May 28, 1922, p. 425).

Character of the Forest.—*Serbia.*—The eastern part of Serbia is very little wooded; hardwoods (beech and oak) occur in the east and north, while conifers (fir, spruce, and pines) are found in the west and south. On the whole, the broadleaf forests predominate, firewood being the chief product. Coniferous and mixed forests are largely in the mountains, and transportation facilities must be improved before these forests can be exploited to any great extent for commercial purposes.

Bosnia and *Herzegovina* have large stands of spruce and pine covering nearly 2½ million acres, some of which are still virgin. The fine oak forests of the lowlands are nearly exhausted. *Quercus cerris* is the only species which is still present in abundance.

Slovenia, which includes southern Croatia, southern Styria, Carniola, and parts of Istria, all of which formerly belonged to Austria, contains 30 per cent coniferous, 25 per cent mixed, and 45 per cent broadleaf forests.

In *Croatia* and *Slavonia* only about 11 per cent of the forests are coniferous. This territory lies in the midst of the broadleaf belt including eastern and southern Hungary, Slavonia, Croatia, eastern Carniola, southern Styria, and northeastern Bosnia. Beech is the principal species here, but it is by no means as important economically as oak, which occurs in association with it. Slavonian oak has a world-wide reputation. The remaining stock of this species will last only a few decades. In addition to oak, the following species are represented in the forest: ash, basswood, poplar, hornbeam, beech, and maple. Oak is gradually giving way to these species in younger stands.

Montenegro contains extensive stands of coniferous timber in the mountains, but these forests are inaccessible for want of roads, and hence unexploited. The high mountains in the north are covered with pine forests. At the mountain tops the vegetation is alpine in character, but in the sub-alpine zone, about 6,000 feet, there occur pine forests and below them beech, then oak and walnut. Beech is the prevailing species up to 5,000 feet in altitude. Forests occupy about 30 per cent of the total land area, or 700,000 acres.

On the whole, therefore, Jugo-slavia may be characterized as a country in which broadleaf species predominate; it may be safe to place conifers at 25 per cent and hardwoods at 75 per cent of the total forest area.

Character of Ownership.—It is impossible to determine at present the exact ownership of the forests in Jugo-slavia, as the new political organization will undoubtedly cause changes in this respect. An estimate, however, may be made on the basis of the distribution of the forests according to ownership as it existed in the provinces before they became a part of Jugo-slavia.

Table 112.—Pre-war Distribution of Forests According to Ownership

Province	State	Communes	Church	Private forests	Total
Serbia	1,417,230	1,645,650	42,707	759,187	3,864,774
Per cent	36.7	42.6	1.1	19.6	....
Bosnia and Herzegovina	5,016,500	....	....	1,363,500	6,380,000
Per cent	78.6	....	....	21.4	....
Croatia and Slavonia	724,000	394,000	92,000	2,559,000	3,769,000
Per cent	19.2	10.5	2.4	67.9	....

No data are available regarding the character of ownership in Slovenia and Montenegro. Furthermore, the boundaries of the property of different forest owners in many of the provinces are very uncertain and still disputed. For Jugo-slavia as a whole the state owns 42.2 per cent, the communes 22.3, private individuals and communes jointly 29.1, and the church 6.4.

Annual Growth, Cut, and Consumption.—No figures are available regarding the cut, yield, or consumption of wood. The best figures that can be given are mere estimates. The forests of some of the provinces of the former Austrian empire, such as Croatia and Slavonia, produced at the rate of 40 to 43 cubic feet per acre per year. On the other hand the forests of Serbia and Montenegro were evidently greatly depleted. If the entire 17¼ million acres were productive forest land, it would be comparatively easy to determine the total annual growth. Some of this land, however, is undoubtedly not productive forest land, and therefore the average annual growth would fall below 40 cubic feet. Moreover with the hardwoods predominating, the growth per acre, especially of sawlog material, must be comparatively low. At 40 cubic feet per acre the total forest area of Jugo-slavia would indicate an annual growth of 690,000,000 cubic feet. Although the country is largely agricultural, before the war the domestic consumption of Austria-Hungary, of which most of the country was a part, was fairly high. Assuming that the per capita consumption of wood in Jugo-slavia is about 43 cubic feet for a population of 14,800,000 people, this would make an annual consumption of 641,400,000 cubic feet. At an annual cut estimated at 783,660,000 cubic feet and a consumption of 641,400,000 cubic feet, Jugo-slavia could provide a surplus of about 142,260,000 cubic feet of sawtimber for export abroad, when her forests are made accessible for exploitation by the construction of roads and other means of transportation. It is evident that at such a rate of cutting, Jugo-slavia, like Austria-Hungary before the war, is over-cutting her forests.

Imports and Exports.—Some of the countries which now form provinces of Jugo-slavia, like old Serbia and Montenegro, before the war had an excess of imports over exports. From this it may be inferred that the forests of those provinces have not yet been opened up or that they are already ruined by abuse, because with a forest area of 1.55 acres per capita and undeveloped industries, as was the case in Serbia, the forests should be fully able to supply the needs of home consumption. It was different, however, with Bosnia and Herzegovina, the Slovenian territory, Croatia, and Slavonia. These countries, even before the war, had an excess of exports over imports.

The exploitation of the forests of Bosnia and Herzegovina was just beginning before the war. Timber is the chief Bosnian export, the average annual amount exported being 211,800,000 cubic feet. Over one-third of these exports are sent to Italy, chiefly to Sicily and Sardinia. The greater part of the remainder goes to Egypt. Among the chief centers of the industry in Bosnia and Herzegovina are Doberlin, Drvar, Gornji, Podgradats, and Zavidovitch. In these provinces are many sawmills using steam and water power. The yearly output of sawn timber is given as:

	cu. ft.
Spruce	211,180,000
Beech	4,589,000
Oak	12,355,000

Foreign capital has been invested on a large scale in the forests of Bosnia, Herzegovina, and Slovenia. Railways and sawmills have been built in the forests. The timber industry has also begun to grow in Croatia and Carniola. There is no doubt that large amounts of timber will be exported from these regions as soon as Fiume is opened up. An Italian company, "La Foresta," has been formed at Milan for timber trade, with a capital of $9,650,000. This company has control of extensive forests in former Austria-Hungary and Rumania, and purposes to send large quantities of timber to France and Italy for reconstruction work.

Slovenia has 2,000 water sawmills and 35 steam sawmills. An average yearly total of 1,765,000 cubic feet is exported from Slovenia to Italy and Spain. Before the war much furniture was produced for export, and as soon as prices are stabilized the trade will probably be resumed. Bentwood furniture is produced at Varazdin for export to all parts of the world. Distillation of wood is carried on at one or two factories in Bosnia, producing charcoal, acetone, methyl alcohol, etc.

Timber trade moves almost exclusively by railways in Jugo-slavia. Rumania monopolizes the wood export trade to the east, hence Jugo-slavia has no occasion to make use of the Danube and Save Rivers for timber transportation except for fuelwood.

Wood-Using Industries.—Wood industries are represented by cellulose, tanning, and wood distillation plants, as well as by sawmills. Charcoal burning is also a wide-spread industry. There are important plants for manufacturing and treating railway ties both for home use and for export. These industries are located mostly in Bosnia and Herzegovina. The products are shipped partly to Fiume, partly by rail to Sebenico, Metkowic, or Gravosa. A small amount of building timber, lumber, and fuel goes to southern Hungary and Serbia.

Forest Laws.—The different provinces which compose Jugo-slavia had, as a rule, their own forest codes. The forest policy of the new country as a whole has not yet been formulated, and upon this policy will depend the future of the forests of Jugo-slavia. Old Serbia had no legislation looking toward forest protection. Every citizen had the right to cut timber for his own needs in the state forests, although he had to pay for what he cut for sale. Under such a system of cutting there could hardly be any regular forest management. On the other hand, such provinces as Slovenia, Croatia, Slavonia, Bosnia, and Herzegovina, which formerly were part of Austria-Hungary, had very stringent laws with regard not only to public forests but to private forests as well.

How well the state forests in the provinces which were a part of Austria were managed may be seen from the fact that the gross revenue per acre in 1912 amounted to $2.50, and the net revenue to $0.70. In other words, 72 per cent of all the revenue from the forests was utilized for the administration and improvement of the state forests. After 1852 the Austrian government recognized a special class of private forests—the so-called protection forests. All forests whose destruction would increase the danger from erosion, avalanches, rock slides, or cause the movement of sand, could not be cut clean. In 1910, about 12½ to 13 million acres of private forests came under this regulation. Whether the present government of Jugo-slavia will retain these laws and extend them to other provinces is to be seen. There is danger that in the reconstruction period the government, in its desire to hasten rehabilitation, may overcut the forests. Even before the war Austria reached the limit of its forest exploitation, and in some localities had actually been cutting in excess of the growth. Jugo-slavia is destined at any rate for some time to take, at least in part, the place of Austria-Hungary in supplying many of the European countries with timber. Whether it will be able to maintain a leading export trade for a long time will depend largely upon the manner in which the newly acquired forests are handled.

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LATVIA

Forest Area.—The newly established State of Latvia has an area of 15,642,000 acres and a population of 2,500,000. Latvia was formed from part of the old province of Livonia and the whole province of Kurland. The forest area must be in the neighborhood of 3 million acres, or 19.4 per cent of the land area. By provinces it is distributed as follows:

	Acres
Livonia (half)	1,108,450
Kurland	1,931,100
Total	3,039,550[1]

The forest area is 1.2 acres per capita.

Character of the Forest.—Latvia, like Esthonia, lies within the region of temperate hardwoods and conifers. Scotch pine and spruce predominate, forming probably 65 per cent of the total forest.

Character of Ownership.—Private forests predominate.[1] In the province of Kurland public forests occupy only 752,800 acres, or 39.0 per cent, while in the portion of Livonia now included in Latvia about 15 per cent, or 162,900 acres, are under public ownership.

Growth, Cut, and Consumption.—The growth may probably be assumed as 35 cubic feet per acre, while the consumption is about 50 cubic feet per capita and the cut is in excess of the present growth. With regard to the lumber industry Latvia, just as Esthonia, is chiefly a shipper, trader, and manufacturer of raw material originating in Russia.

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[1] Recent estimates give a forest area of 4,200,000 acres. Since the war, public forests are reported to comprise 87 per cent of the total.

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LITHUANIA

Forest Area.—As far as can be determined the present land area of Lithuania is 23,400,000 acres and the population approximately 4,650,000. Lithuania is formed of three old Russian provinces, Suwalki, Kovno, and Vilna, except the region surrounding the city of Vilna, which is a part of Poland. The forest area must be in the neighborhood of 4,466,500 acres (1 acre per capita), distributed by provinces as shown in Table 113.

TABLE 113.—FOREST AREA OF LITHUANIA

Province	Forest area	Per cent of total land area under forest
	acres	
Suwalki	648,100	20.9
Kovno	1,634,300	16.5
Vilna	2,184,100	21.1
Total	4,466,500	19.1

Character of the Forest.—Lithuania is in the region of mixed temperate hardwoods and conifers. Conifers predominate, forming 70 per cent and the hardwoods about 30 per cent. In the province of Kovno spruce exceeds pine, while in Vilna there is more pine than spruce.

Character of Ownership.—Before the war the forests in the three provinces were distributed by ownership as given in Table 114.

Private forests predominate. Lithuania is without mineral deposits of commercial importance and must depend primarily upon its forests and crops for means of livelihood and commerce. The chief occupation is a primitive type of agriculture with cereals, flax, and potatoes as the principal products. Although it is better endowed with forests than either Esthonia or Latvia, the forests being mostly in private

TABLE 114.—PRE-WAR OWNERSHIP OF FORESTS

Province	State	Private	Peasant	All other
Suwalki	493,700	114,700	28,400	11,300
Per cent	76.2	17.7	4.4	1.7
Kovno	447,800	1,181,800	....	4,700
Per cent	27.4	72.3	....	0.3
Vilna	718,100	1,415,100	48,800	2,100
Per cent	32.9	64.8	2.2	0.1

hands have been greatly cut over and cannot maintain a large export trade.

Timber Trade.—Like most of the western provinces of Russia, the region occupied by present Lithuania has been largely a center for the manufacture and shipping of raw materials obtained from other points in Russia—an industry important in many places. The poorer grades are utilized for local needs. Log driving and floating of pulpwood on the rivers Niemen and Vilna to the wood-using establishments and pulp mills in Germany were highly developed before the war. A great many ties are made in the region. The local sawmills work only for local markets. On the whole, the sawmill industry is not well developed, nor are there any large wood-using establishments. There are more men engaged in the home industry than in factories. The great drawback in the past was that there were no lumber yards on the rivers Niemen and Vilna within the Russian border. Russian lumbermen therefore had to ship their products direct into German territory, where there were splendid wood yards and other conveniences. This placed the Russian lumbermen entirely at the mercy of the German traders.

Growth, Cut, and Consumption.—The annual growth is probably the same as the average for European Russia—namely, 35 cubic feet per acre. The consumption is probably about 40 cubic feet per capita. The cut therefore is in excess of the present growth. No figures are as yet available for the cut in Lithuania. The figures given for Russia include Lithuania.

References

See references for European Russia.

THE GRAND DUCHY OF LUXEMBURG

Forest Area.—The total forest area of Luxemburg is 197,600 acres, or 30.9 per cent of the total land area. With a population of 263,824 this constitutes a per capita forest area of 0.7 acre. One-fourth of the forest area, 49,400 acres, consists of coppice managed for tanbark. High beech forest covers 123,500 acres, and coniferous forest 24,700 acres. Conifers thus occupy about 12½ per cent and hardwoods 87½ per cent of the forest. During the last ten years clearings have amounted to about 3,334 acres. The state owns only 4,940 acres, the communes and other public institutions own 74,100 acres, and the rest, which includes almost all the tanbark coppice, belongs to private owners. Nearly two-thirds of the forests thus belong to private owners.

Annual Growth, Cut, and Domestic Consumption.—The growth, cut, and consumption of wood in Luxemburg can not differ materially from its neighbors, Belgium on the west and Germany on the east. With an average growth of only 30 cubic feet per acre, or about 6,000,000 cubic feet in all, the forests of Luxemburg ought to supply a domestic per capita consumption of 22 cubic feet as in Belgium. Luxemburg may, therefore, be considered as self-sufficient in its timber production.

Forest Laws.—The forests of Luxemburg have been cared for up to and including the present time under the forest law of 1905, but since the World War conditions have changed to such an extent that new legislation has become imperative and a bill for such a law is now pending before the Luxemburg Chamber of Deputies.

Under the present law the administration of the forests is assigned to "The Superior Council for Forests and Waterways." The Forest Service comprises five divisions. At the head of each division there is a Chief Forester, who is responsible to the Superior Council for Forests and Waterways. The Forest Service controls and administers all public, communal, and Grand Ducal forests, but does not have the right to regulate or control private or corporate owners of forest lands.

Under the present law private and corporate owners are not restricted as to the disposition they may make of their forest lands, and through this laxness a considerable portion of the Luxemburg forests has disappeared. The law now pending before the Chamber of Deputies provides for the control of lumbering on private as well as public lands and also provides for the reforesting of many of the deforested areas.

In recent years, when forest lands of importance are placed on sale, the Luxemburg government, one of the communes, or the Grand Ducal estate itself usually purchases the parcel as a means of preventing the deforesting of that particular area, there being no other legal means to prevent the cutting of all timber included in such an area.

Although no concessions or subsidies are granted to private or corporate owners, the government is assisting in reforestation by selling trees from its own reserves and nurseries at very low prices. Considerable attention is given in the schools of the Grand Duchy to bringing before the pupils the value of the forests both from the economic standpoint and that of public health, but at present there is no organized effort to educate the public as a whole.

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THE NETHERLANDS

Forest Area.—In the Netherlands for the last seventy-five years there has been a constant increase in the area of productive land at the expense of the non-cultivated and waste land; thus, in 1833, fields, pastures, meadows, and forests occupied 63 per cent of the total land area, and the remaining 37 per cent was swamps, waste land, and roads; in 1910 82 per cent was under crops, forests, and gardens. In sixty-five years the Dutch have transformed 19 per cent of waste and unproductive land into profitable areas. Forests have also increased accordingly; in 1833 the forest area was 417,500 acres, or 5.2 per cent of the land area; in 1881 it was 552,001 acres, or 6.8 per cent of the land area; in 1889 it was 564,000 acres, or 7.7 per cent of the land area, and in 1911, 644,480 acres, or 8.0 per cent. As a result of clearing during and since the war, the area decreased to 612,030 acres in 1920.

The forest area in seventy-five years has increased about 50 per cent. Since the greater part is in the hands of private individuals, this increase must be taken as an indication that forestry is profitable. The per capita forest area is 0.1 acre.

The distribution of the forests is not uniform, ranging from 0.5 per cent (Groningen) to 17.9 per cent (Limburg). The forest areas of the provinces in 1901 are given in Table 115.

TABLE 115.—FOREST AREAS OF NETHERLANDS

Province	Forest area	Per cent of land under forest	Province	Forest area	Per cent of land under forest
	acres			acres	
Groningen	2,784	0.5	South Holland	22,415	3.0
Friesland	19,780	2.4	Zealand	3,720	0.9
Drenthe	28,380	4.3	North Brabant	147,215	12.2
Overyssel	47,967	5.8	Limburg	93,289	17.9
Gelderland	192,971	15.8	Total	622,235	7.6
Utrecht	44,826	13.1			
North Holland	18,888	2.8			

Character of the Forest.—By species the forests were distributed in 1901 as shown in Table 116.

TABLE 116.—DISTRIBUTION OF FORESTS—NETHERLANDS

Province	Composition				
	Broad-leafed	Conifers	Oak for bark	Alder	Willow
	acres	*acres*	*acres*	*acres*	*acres*
Groningen	608	756	353	1,067	....
Friesland	526	1,922	2,246	14,074	12
Drenthe	3,157	11,747	8,771	4,705	....
Overyssel	7,516	22,015	13,269	4,431	736
Gelderland	33,787	80,967	52,989	18,770	6,459
Utrecht	4,043	20,380	10,996	5,313	4,093
North Holland	7,151	1,060	3,722	6,131	825
South Holland	1,247	123	1,922	7,689	11,434
Zealand	370	565	274	2,282	227
North Brabant	4,691	101,191	10,359	21,953	9,021
Limburg	4,740	62,847	7,684	17,466	553
Total	67,836	303,573	113,585	103,881	33,360
Per cent	10.9	48.8	18.2	16.7	5.4
Grand total	622,235				

Of the 640,832 acres of forest (1908), 327,628 acres, or 51.1 per cent, are conifers; 54,975 acres, or 8.6 per cent, are broadleaf forests, and 258,229 acres, or 40.3 per cent, coppice. Conifers thus occupy about half of the forest area. They occur chiefly in North Brabant, Gelderland, and Limburg. The conifers yield but little sawlog timber, the product being principally mine props, exported in large quantities to Belgium and Germany. Oak coppice managed for bark occupies about one-sixth of the entire forest area. About half of these oak forests are in Gelderland. The bark, however, is shipped to the tanning factories in North Brabant. Osier (willow) culture occupies a large area in South Holland, North Brabant, and Gelderland.

Character of Ownership.—In 1909 the state forests occupied 196,291 acres, or 30.6 per cent of the forest area. The rest of the forest, or 69.4 per cent, belonged to private owners and communes:

	Acres	*Per cent*
State forests	196,291	30.6
Private forests	444,541	69.4

Annual Cut and Growth.—Unfortunately, there are no reliable figures concerning the amount of annual cut. The cuts per acre in Netherlands and Belgium are not very different. Judging by the revenues obtained in the Belgian forests, the Dutch forests must yield an even larger amount of wood per acre. An annual cut of about 46 to 50 cubic feet per acre is probably a safe estimate. The total cut would therefore amount to 32,041,600 cubic feet. This figure may also be accepted as the annual growth, since the forests are managed on a sustained yield and the forest area is constantly increasing.

Domestic Consumption.—The annual yield is not sufficient to supply the home consumption. The Netherlands is a commercial nation less developed industrially than Belgium, hence its wood consumption is smaller. Although Netherlands uses enormous quantities of coal and peat and therefore does not use much wood for fuel, it needs large quantities of timber for building purposes. The surplus of imports of ship and structural timber in 1909 was 72,148,000 cubic feet (about one million tons). Adding to this the annual cut at home, 32,041,600 cubic feet, the total domestic consumption would be about 104,189,600 cubic feet, or with a population of 6,600,000, 15.8 cubic feet per capita. Even assuming that 50 per cent of the total cut is cordwood, the consumption of cordwood would form only 2.4 cubic feet while the consumption of timber and lumber would be 13.4 cubic feet per capita.

Imports and Exports.—The amounts of ship timber and other construction timber imported into the Netherlands by countries of origin for the period 1888 to 1909 are given in Table 117.

The exports of ship and structural timber from the Netherlands by countries of destination for the period 1905 to 1909 are given in Table 118.

Of the ship and structural timber imported into the Netherlands, there remained in the country for internal consumption only about 72,000,000 cubic feet, the remainder being reexported.

Russia is the principal exporter of timber and lumber into the Netherlands and the quantity is growing year by year. Russia, however, supplies more timber than lumber. Sweden and Norway, on the other hand, furnish more lumber than timber, although the export from these two countries on the whole is decreasing. There are no import duties either on round timber or on sawn lumber in the Netherlands.

The United States furnishes chiefly pitch pine (*Pinus palustris*). Lately, however, the prices for pitch pine nearly reached the prices for oak, and cabinet makers are turning to the use of oak. A great deal of oak is imported into the Netherlands for cabinet making, doors, frames, and interior finish in houses and railroad cars. Oak comes mostly from Austria, Germany, and the United States. Much American oak is rejected because of its brittleness.

TABLE 117.—IMPORTS INTO NETHERLANDS OF SHIP AND STRUCTURAL TIMBER, BY SOURCES

Year	Russia		Sweden		Norway		Prussia		Belgium		Hamburg		Other countries		Total cu. ft.
	Cu. ft.	Per cent	Cu. ft.	Per cent	Cu. ft.	Per cent	Cu. ft.	Per cent	Cu. ft.	Per cent	Cu. ft.	Per cent	Cu. ft.	Per cent	
1888....	17,773,550	......	17,578,200	......	4,613,639	.....	10,240,177	......	2,602,034	.....	....	.....	....	......	....
1898....	40,570,361	36.6	19,355,484	17.4	7,070,449	6.4	17,211,292	15.5	4,476,111	4.0	369,520	0.3	21,975,309	19.8	111,028,526
1899....	43,625,787	37.6	19,068,707	16.4	6,781,130	5.8	15,180,765	13.1	5,047,053	4.3	666,746	0.6	25,812,419	22.2	116,182,607
1900....	46,998,138	39.0	19,883,290	16.5	5,350,562	4.4	14,161,019	11.8	5,621,172	4.7	529,218	0.4	27,875,916	23.2	120,419,315
1901....	48,273,385	44.0	14,361,240	13.1	4,197,099	3.8	16,271,606	14.8	4,256,192	3.9	460,100	0.4	21,949,681	20.0	109,769,303
1902....	50,710,639	43.3	18,106,711	15.4	5,155,918	4.4	14,638,133	12.5	4,952,378	4.2	472,102	0.4	23,167,602	19.8	117,203,483
1903....	60,622,384	44.9	18,920,235	14.0	4,494,820	3.3	13,321,161	9.9	5,264,360	3.9	403,479	0.3	32,058,613	23.7	135,085,052
1904....	70,237,045	46.4	18,300,508	12.1	4,730,412	3.1	12,802,392	8.5	6,116,996	4.0	639,707	0.4	38,616,223	25.5	151,443,283
1905....	74,902,646	48.0	21,356,218	13.7	4,945,530	3.2	13,043,279	8.4	5,190,794	3.3	772,717	0.5	35,747,675	22.9	155,958,859
1906....	86,805,242	49.6	21,517,115	12.3	5,698,126	3.3	14,433,888	8.3	4,553,912	2.6	859,131	0.5	40,932,044	23.4	174,799,458
1907....	91,048,584	54.3	12,753,890	7.6	3,711,724	2.2	16,223,103	9.7	5,416,220	3.2	692,233	0.4	37,952,654	22.6	167,798,408
1908....	115,804,403	59.5	13,625,941	7.0	3,800,398	2.0	18,743,947	9.6	5,408,101	2.8	569,671	0.3	36,473,443	18.8	194,425,904
1909....	107,700,794	59.0	13,051,469	7.2	3,352,865	1.8	18,975,939	10.4	5,702,574	3.1	595,582	0.3	33,115,707	18.2	182,494,930

TABLE 118.—EXPORTS FROM NETHERLANDS OF SHIP AND STRUCTURAL TIMBER, BY COUNTRIES OF DESTINATION

Country	1905		1906		1907		1908		1909	
	Cu. ft.	Per cent	Cu. ft.	Per cent	Cu. ft.	Per cent	Cu. ft.	Per cent	Cu. ft.	Per cent
Prussia..................	67,537,866	78.9	73,963,102	76.7	86,205,071	80.5	97,982,069	78.8	87,795,830	79.6
Belgium..................	14,163,137	16.6	17,134,902	17.8	16,231,364	15.2	17,590,696	14.2	17,758,512	16.1
Other countries..........	3,874,599	4.5	5,295,212	5.5	4,634,749	4.3	8,684,294	7.0	4,792,611	4.3
Total............	85,575,602	100.0	96,393,216	100.0	107,071,184	100.0	124,257,059	100.0	110,346,953	100.0

Walnut for cabinet making is being imported from Caucasus; also from Italy and southern France. This wood comes through Rotterdam as do all precious woods, the so-called "bois des îles": rosewood, mahogany, ebony, teak, and others.

Ports.—Nearly all the timber from abroad is imported through the seaports of Rotterdam, Amsterdam, Zaandam, Dordrecht, Harlingen, Delftzijl, Terneuzen, and Middelburg. A small amount of timber enters in the form of rafts by way of the Rhine from Germany. From 50 to 60 per cent of all the timber imported comes through Rotterdam. Amsterdam is the next largest port through which forest products enter. In 1909, 11.6 per cent of all the ship and other structural timber imported entered through Amsterdam, and the amount is constantly increasing. Russian timber came from the ports of the White and Baltic Seas. The timber from Archangel was valued more highly than any other timber on account of its high technical qualities. A great deal of sawn material came from Danzig, but this was also Russian timber exported to Prussia in round logs and there sawn and reexported to the Netherlands.

Wood-Using Industries.—A great deal of timber is still being used for shipbuilding. Thus in 1908 there were built 100,000 tons of ships, in the construction of which 25,000 tons of wood were used. Since the number of wooden ships decreases from year to year, the demand for ship timber will probably decrease. Only two firms are engaged in the construction of wooden ships—in Rotterdam, Boot & Zonnen, and in Zaandam the shipyard "Czaar Peter."

According to the industrial census of 1899 there were 22,253 individual wood-working plants, employing 59,000 workers. Most of these workers, 17,763, were in South Holland, 6,061 in Gelderland, 5,252 in North Brabant, 3,654 in North Holland, 3,409 in Overyssel, and so on. Table 119 below gives an idea of the distribution of these workers by their specialties.

TABLE 119.—DISTRIBUTION OF WOOD WORKERS

Trade	Number of enterprises	Number of workers	Trade	Number of enterprises	Number of workers
Carpentry and cabinet making	13,658	38,954	Turning	444	1,115
Furniture	2,239	7,082	Box manufacture	58	780
Wooden shoes	3,279	3,139?	Wooden lasts	101	433
Stave making	1,459	2,884	Basket making	60	600
Hoop making	213	1,874	Sawmill	297	3,172

Most of the wood-using plants are small. The largest numbers of carpenters and cabinet makers are in South Holland and North Holland. The furniture making is centered in South Holland, North Holland, and Limburg. The manufacture of wooden shoes is chiefly in Gelderland and North Brabant. Barrel making is in the provinces of South Holland, Friesland, and North Brabant. A large number of barrels are manufactured for the export of herring and butter. The basket industry is highly developed because of the abundance of willows. Most of the sawmills are in South Holland, Gelderland, North Brabant, and Overyssel. The largest sawmills are in The Hague, Drent, and Utrecht. One of the oldest sawmills, Dekker, in The Hague, has existed since 1885, and manufactures chiefly sash and doors. It uses mostly Russian, Finnish, and Swedish timber. It is of interest that the first sawmills in Europe were built in the Netherlands, which at one time supplied Europe with sawn timber. Windmills were utilized as the motive power. In the 11th century there were about 600 such sawmills operated by means of windmills; they are now a thing of the past.

The Forestry Movement.—Forest administration began in the Netherlands in 1898, when a Division of Agriculture was created in the Department of the Interior. At present the Forest Service is in the Department of Agriculture, Industry, and Trade. The staff in the Netherlands proper is very small, comprising one forest inspector, two foresters, and 20 forest guards. The state forests are situated on dunes, shifting sands, and heath. Private owners and communes have complete freedom in handling their forests according to their own discretion. There is no limitation in the right of usage and no forest protective laws, yet the forest area was constantly increasing until 1912.

In 1833 the forests occupied 417,494 acres; in 1890, 563,758 acres; in 1901, 622,235, and in 1908, 640,832. Thus during 75 years the forest area increased by 223,338 acres, or 53 per cent. This increase proceeds at the expense of heath waste, of which there are about 1,482,000 acres, or 18.1 per cent of the total area of the country. These waste lands are at present suitable only for the pasturing of sheep, and bring an insignificant revenue of 8 to 12 cents per acre. The afforestation of the heath wastes is being aggressively pushed by a private association, Netherlandsche Heidematschappij, which was founded in 1888. The purpose of this association is the improvement of the heath wastes, their drainage and conversion into pastures and forests. It publishes a periodical journal, *Tidschrift de Nederlandsche Heidematschappij.* In 1903 the association had 235 honorary members and 2,719 active members. It receives an annual subsidy of $3,600 from the government. The association maintains a school for the training of instructors with a three-weeks' course. It has at its disposal 90 instructors for the supervision of the afforestation work, animals and tools for doing the work, and supplies of seed and planting material. The association takes contracts for drainage and afforestation of heath wastes. As an indication of its growth it may be mentioned that in 1890 the number of applications for the afforestation of heath wastes was 35 and the area involved 69 acres. In 1908 there were 1,687 applications and the area involved was 4,426 acres. The payroll amounted to $197,189, and the number of employees was 211. During a period of 19 years the association converted 33,839 acres of heath wastes into forests at a cost of $898,160.

In 1907 a law was passed which authorized loans to communities for afforestation of waste land. The afforestation of waste lands is not compulsory upon the communities, but in case the communities do wish to undertake work of this character the government is ready to loan funds. The procedure for obtaining loans is as follows:

1. The community makes application for the afforestation of a certain area of waste land and attaches a general plan.
2. The forest administration examines the areas on the ground and prepares a plan for afforestation.
3. The loans are advanced to the amount of 80 per cent of the cost of the work, and must be returned in the course of 50 years without interest. The cost of afforestation of one acre must in no case exceed $20.
4. The work is carried out under the direction and supervision of government technical foresters.
5. Plantations established in this manner are subject to government supervision, and no cuttings can take place in them without the permission of the forest administration.

A great deal, therefore, is done in the Netherlands toward increasing the forest area at the expense of waste land and other land unsuitable for agriculture. In a few decades the waste lands will be only a memory, just as in the south of France, in the course of 50 years, from 1837 to the end of the 19th century, about 1,729,000 acres of sandy wastes (82 per cent of the entire area) were converted through the efforts of private individuals into valuable stands of maritime pine.

Education.—The comparatively small forest area of the country would hardly justify the maintenance of a forest school for the training of the higher forest personnel for service at home. Since the Netherlands, however, is greatly interested in developing the enormous forest wealth in her colonies, a forest department for the training of higher forest personnel for service in the colonies was created in 1899 at Wageningen, eleven miles west of Arnhem, at the Institute of Agronomy and Horticulture. This is a school of high standing similar to a university, and has a three-year course for those who intend to work in Europe and a four-year course for those who plan work in the colonies.

The extra year is used for the study of the forest flora of the colonies, colonial forest policies, and native languages of the colonies. The forest department graduates about ten persons every year.

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NORWAY

Forest Area.—The total land area of Norway is about the same as that of Japan, Italy, or the British Isles, and comprises 79,443,200 acres (124,643 square miles), divided as follows:

Land utilization	Per cent
Total land for agricultural purposes	3.4
Forest land	21.4
Towns and cities	0.1
Unproductive land (mountain pastures, glaciers, swamps, etc.)	71.0
Inland water	4.1
Total	100.0

The total forest area is 17,000,000 acres, or 21.4 per cent of the land area. Formerly the acreage of forests was about 30 to 35 per cent larger than at present. Not all of this forest land, however, is productive. Productive forest land totals about 14,000,000 acres; non-productive about 3,000,000 acres. The productive forests thus occupy only 17.7 per cent of the area of Norway. The distribution of the forests by provinces is given in Table 120.

The bulk of the forests lies in the northeast, where the proportion of forest to total area is 38 per cent. In the north the forest occupies only 6 per cent of the land area and in the central part 13 per cent. The per capita productive forest area is 5.3 acres. Western Norway is practically treeless. Convenient access to the western coast with its deep sheltered fiords has caused the depletion of the forests in that region. It is estimated that during the last 150 years 15,000 acres of private forests have been cleared each year. Practically no virgin forests are left in Norway.

The forests are largely in small holdings. Some large timber areas are owned by wood-using industries and pulp and paper plants. Norwegian forests produce only a small part of what they could produce with proper management. The people in Norway are just beginning to realize the importance of forests and the necessity for suitable legislation. The state has been acquiring forest land by purchase, mostly cut-over land such as only the state could afford to hold because no immediate financial return is possible from it. About 548,000 acres have been acquired by the Government since 1860.

TABLE 120.—FOREST AREA OF NORWAY

Provinces	Area of productive forest	Ratio of productive forest to total area of province	Area of non-productive forest	Ratio of non-productive forest in each province	Total area of forest land	Total per cent
	acres	*per cent*	*acres*	*per cent*	*acres*	
Smaalenene	556,985	53.9	63,973	6.2	620,958	60.1
Akershus	769,405	58.2	58,045	4.4	827,450	62.6
Hedemarkens	2,742,688	40.3	337,402	4.9	3,080,090	45.2
Kristians	1,168,804	18.7	190,684	3.1	1,359,488	21.8
Buskerud	1,128,049	30.8	94,601	2.6	1,222,650	33.4
Jarlsberg and Larvik	315,913	54.8	20,007	3.5	335,920	58.3
Bratsberg	1,260,194	33.6	141,037	3.8	1,401,231	37.4
Nedenes	701,233	30.4	155,116	6.7	856,349	37.1
Lister and Mandal	367,536	20.5	91,884	5.1	459,420	25.6
Stavanger	241,566	10.7	29,146	1.3	270,712	12.0
Southern Bergenhus	421,629	10.9	75,088	1.9	496,717	12.8
Northern Bergenhus	473,746	10.4	71,877	1.6	545,623	12.0
Romsdal	527,839	14.2	84,474	2.3	612,313	16.5
Southern Trondhjem	960,089	20.8	425,581	9.2	1,385,670	30.0
Northern Trondhjem	915,135	16.5	365,313	6.6	1,280,448	23.1
Nordland	672,087	7.1	199,823	2.1	871,910	9.2
Tromso	390,013	5.9	123,006	1.8	513,019	7.7
Finmarken	446,823	3.8	450,775	3.8	897,598	7.6
Total	14,059,734	17.7	2,977,832	3.7	17,037,566	21.4

Character of the Forest.—Conifers occupy 75 per cent and hardwoods 25 per cent of the total forest area. The principal coniferous species are pine (*Pinus sylvestris*) and spruce (*Picea excelsa*). The chief broadleaf species are birch, beech, elm, and oak, especially pedunculate oak. The hardwoods do not play an important part economically. Beech forms forests only south of Christiania; oak occurs on the southern and eastern coasts up to 63° north latitude; birch is the only hardwood species which extends beyond the Arctic Circle inland as well as along the coast.

The most common tree is pine, which is found throughout the country up to 70° north latitude and forms the most northern forest in existence. Its vertical range is higher than that of spruce (occurs at 3,100 feet above the sea in southern Norway and 650 feet in the extreme northern part). The average height of trees is from 55 to 65 feet. Pine ordinarily reaches maturity at 150 years, but in the mountains and in the north requires 200 years. As virgin forests have entirely disappeared, large timber is seldom found.

Spruce is gradually replacing pine where the latter has been cut out. It is more valuable than pine at present, since it is much in demand for pulp. It does not extend beyond the Arctic Circle and grows on the western coast only scatteringly or singly. The limit of its vertical range is about 2,800 feet above sea level in the south and 500 to 600 feet in the north. The best spruce stands are found in the region bordering on Kristiania Fjord and in Trondelagen district. In the south it can be utilized at the age of 70 to 80 years; in the rest of the country between 120 and 150 years. No other native coniferous species of importance occur naturally in Norway, but some exotic conifers, such as larch, American white pine, Douglas fir, and others, have been introduced and grow well.

Birch, the principal broadleaf species, occurs throughout the country to 70° 40′ north latitude and extends up to 4,900 feet above sea level in southern Norway and to 1,000 feet in the north. The best birch is found in the east. Alder, beech, oak, aspen, ash, maple, elm, and basswood are of little importance. They occur in small quantities and occasionally in scattered stands, and usually mixed with conifers. All the hardwoods are used locally. They are insufficient to meet domestic requirements, however, and large quantities are imported. The approximate percentages of pine, spruce, and broadleaf species by regions are as follows:

Region	Pine	Spruce	Broadleaf
Northern Norway	28	14	58
Trondelagen	28	42	30
Western Norway	34	....	66
Southern Norway	44	38	18
Eastern Norway	34	55	11
Average	34	41	25

Character of Ownership.—Public forests occupy 21 per cent of the productive forest area as against 33.4 per cent in Sweden and 35 per cent in Finland. If all forest land is considered, the area owned by the state is only 12.4 per cent. Formerly the state forests occupied larger areas, but were sold to private interests, communes, and counties. Considerable areas, however, have been purchased back by the Government since 1860. The character of the ownership in 1907 is shown in Table 121.

TABLE 121.—OWNERSHIP OF NORWEGIAN FORESTS

Class of ownership	Acres	Percentage
Private forests (in small holdings)	7,371,000	52
Sawmills and pulp and paper mills	3,664,000	26
Other industries and larger holders		
Mines and charitable institutions	156,900	1
State forests	2,107,800	15
Counties and communes	765,300	6
Total	14,065,000	100

Private forests constitute 79 per cent of the productive forests. Large corporations, such as sawmills, pulp and paper mills, and others, own 26 per cent of the productive forest area, while more than half (52 per cent) of all the forests is in the hands of small owners. Within recent years, however, the large corporations have been increasing their holdings at the expense of the small woodlot owners. The law gives counties and communes first option on timberlands offered for sale. Norway is one of the few countries in Europe where small holdings predominate. Although such small farm woodlots are important to the well-being of the farmers, as a whole they do not lend themselves to proper management and therefore are a contributing factor to the depletion of the forests of the nation. Among the larger timber holders are the pulp mills, which own the best timber in Norway as to both location and quality. Most of these holdings include coniferous timber. Thirty-five per cent of all coniferous forests of Norway belong to this class of ownership and the forests are usually well managed.

The distribution of the government forests, in 1916, by provinces, is given in Table 122.

Most of the public forests are located in the north and about half of them north of the Arctic Circle. The value of the state forests in 1916 was estimated at $15,899,000. The actual value, however, is lower because of the exercise of the privilege of cutting wood for fuel, building material, and so on. The net value of state forests is therefore placed at about $13,600,000.

Amount of Standing Timber.—The total standing timber is estimated at between 10 and 12 billion cubic feet, but the figures are of doubtful value. The average stand per acre of productive forest land for the entire country is probably between 787 and 858 cubic feet.

TABLE 122.—AREA OF PRODUCTIVE PUBLIC FOREST LAND OF NORWAY

Province	Coniferous forests	Broadleaf forests	Total
	acres	*acres*	*acres*
Finmarken	176,370	498,693	675,063
Tromso	58,946	113,877	172,823
Nordland	110,975	224,269	335,244
Northern Trondhjem	201,127	37,233	238,360
Southern Trondhjem	74,687	52,312	126,999
Romsdal	22,179	4,212	26,391
Northern Bergenhus	11,463	7,987	19,450
Southern Bergenhus	10,338	1,741	12,079
Stavanger	10,762	1,251	12,013
Lister and Mandal	6,438	812	7,250
Nedenes	6,020	477	6,497
Bratsberg	32,945	20	32,965
Jarlsberg and Larvik	2,462	330	2,792
Buskerud	57,180	659	57,839
Kristians	93,166	121,775	214,941
Hedemarken	254,079	31,707	285,786
Akershus	17,307	435	17,742
Smaalenene	3,850	54	3,904
Total	1,150,294	1,097,844	[1]2,248,138

[1] These figures are slightly higher than those previously given. They are of a more recent date and are computed on a different basis.

Value.—The present value of all productive forests in Norway is estimated at about $250,000,000, or 10 to 12½ per cent of the total wealth of Norway (2 to 2½ billion dollars).

Annual Growth.—The annual increment, based on the supposition that the total stand is 11,162,000,000 cubic feet and the increment is 2.8 per cent of that amount, has been estimated at 312,500,000 cubic feet. Calculating the annual growth for each district, the total annual increment has been computed to be 342,616,000 cubic feet. This represents an average annual increment of from 22.2 cubic feet to 24.4 cubic feet. The variation of the increment by districts is shown on page 257.

The total annual waste due to incomplete utilization is estimated at about 22,100,000 cubic feet, leaving a net increment of 290,400,000, or at the higher estimate 320,500,000 cubic feet.

Annual Cut.—The total annual cut is in the neighborhood of 432,000,000 cubic feet. Of this, 133,400,000 cubic feet is exported in the form of various forest products, including pulp and paper. This represents an annual cut of 30.7 cubic feet per acre of productive forest land.

The annual cut for all purposes in the Norwegian forests, based on figures for 1908–1912, is as follows:

		cu. ft.
Wood for domestic use		298,600,000
Wood for export:		
Raw material—		
For rough and planed lumber	43,300,000	
Round and hewn timber	8,100,000	
Mechanical wood pulp	26,300,000	
Chemical pulp	31,700,000	
Paper and card board	23,700,000	
Joinery and cooperage	300,000	
		133,400,000
Total		432,000,000

At an annual cut of 432,000,000 cubic feet and an annual net increment of 290,400,000 to 320,500,000 cubic feet, it is evident that the forests of Norway are now being overcut at the rate of from 112 to 142 million cubic feet a year.

ANNUAL INCREMENT BY DISTRICTS—NORWAY

Districts	Average annual increment per acre	Total annual increment
	cu. ft.	*cu. ft.*
Eastern, western, and southern Norway	28	272,106,000
Trondelagen	24	49,443,000
Northern Norway	14	21,067,000
Total	24	342,616,000

Domestic Consumption.—Deducting from the annual cut the amount of timber exported and adding about 12,400,000[1] cubic feet of wood which Norway imports annually, the annual domestic consumption is in the neighborhood of 311,000,000 cubic feet. This would indicate a per capita consumption of 118 cubic feet. If the wood used for the manufacture of pulp and paper is considered as a part of the domestic consumption, the per capita consumption becomes about 149 cubic feet. The domestic consumption of Norway, if we disregard the consumption of pulpwood for the manufacture of pulp and paper for export, is remarkably close to that of Sweden (129 cubic feet).

Losses from Fire.—Forest fires cause little damage in Norway, owing to an efficient forest patrol system. The forests are kept free from underbrush and the climate is moist with an abundant snowfall in winter, which circumstances help to prevent fires. There are no absolutely reliable data regarding forest fires, but the average area burned over annually from 1870 to 1900 is estimated at about 900 acres. The following statistics are for the whole country, and cover the period from 1913 to 1917, inclusive:

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[1] The import of Russian-Finnish-Swedish wood in 1913 amounted to 25,553,000 cubic feet, but a large part of this import was reexported.

Year	Total forest area destroyed by fire
	acres
1913	370
1914	1,500
1915	980
1916	3,800
1917	790

Export Trade.—The timber export of Norway in 1913 formed 21.0 per cent in value of the total export trade and about 30 per cent of the total timber cut in the country. The most striking feature of the export for the decade is the rapid decrease in the amount of lumber and timber export and the increase in the amount of export of pulp and paper. The export of timber and lumber is shown in Table 123.

TABLE 123.—EXPORT OF LUMBER AND TIMBER OF ALL KINDS, BY QUANTITY AND VALUE

Years	Quantity	Value	Years	Quantity	Value
average	*cu. ft.*		*average*	*cu. ft.*	
1830–1835	26,500,000	....	1876–1880	60,600,000	$9,479,000
1836–1840	33,100,000	....	1881–1885	66,800,000	9,630,000
1841–1845	36,500,000	....	1886–1890	65,000,000	8,432,000
1846–1850	36,800,000	....	1891–1895	62,300,000	7,550,000
1851–1855	48,000,000	....	1896–1900	69,100,000	10,689,000
1856–1860	54,100,000	....	1901–1905	66,800,000	....
1861–1865	64,100,000	....	1906–1910	56,060,000	10,434,800
1866–1870	74,600,000	$8,239,000	1911–1916	39,540,000	10,032,200
1871–1875	82,100,000	11,818,000			

The chief export centers of Norway are Frederikstad, through which 38.4 per cent of all the export trade took place in 1913 and 24.2 per cent in 1920, and Christiania, which in 1920 handled 13 per cent of all the export trade as against 10½ per cent in 1913. The export trade of Norway is distributed as follows among the different countries:

TABLE 124—DISTRIBUTION OF EXPORTS

Country	Per cent of total export		Country	Per cent of total export	
	1913	1920		1913	1920
England	59.4	72.4	France	1.5	2.7
Australia	14.8	7.8	Denmark	1.2	0.3
Belgium	6.0	8.5	Canary Islands	1.2	0.0
Africa	4.7	2.0	Ireland	0.7	0.0
Germany	3.3	0.0	Iceland	0.7	0.4
Netherlands	3.0	4.4	Spain	0.0	0.4
Sweden	2.6	0.4	Other countries	1.0	0.6

The United Kingdom, Australia, and Belgium take more than three-fourths of the entire export of timber and lumber. The remainder goes chiefly to Africa, Germany, Netherlands, and France. The lumber export trade reached its highest point about 15 to 20 years ago and has since been steadily declining in quantity. During the war the high prices and the great demand abroad for lumber products stimulated export. This export cannot be maintained, however, because Norway has not enough forests to produce large quantities of raw material for export. The export of planed lumber within the 10-year period 1906 to 1915 decreased 39.1

TABLE 125.—EXPORTS OF PULP AND PAPER IN QUANTITY AND VALUE

Years	Mechanical and chemical pulp	Paper and cardboard	Value of mechanical and chemical pulp
average	*metric tons*	*metric tons*	
1866–1870	114	6	....
1871–1875	4,605	110	$107,000
1876–1880	18,644	976	724,000
1881–1885	67,909	3,262	1,742,000
1886–1890	152,178	5,015	2,653,000
1891–1895	222,658	18,642	4,476,000
1896–1900	328,547	41,010	7,129,000
1901–1905	433,129	55,966	9,273,000
1906–1910	578,904	115,102	....
1911–1916	678,766	216,347	21,783,200

per cent. The export of rough lumber for the same period dropped 34.5 per cent. Box shooks from 1906 to 1915 showed an increase of 7.8 per cent, while split wood and fire wood dropped 83.6 per cent during the same period. Staves decreased 75.7 per cent from 1906 to 1915. The export of mine timber decreased 40.2 per cent from 1906 to 1915. Exports of pit props dropped 67.7 per cent from 1906 to 1914, but increased temporarily during 1915–1916, because of the war. The entire export of timber and lumber decreased for the eight-year period preceding the war from 71,000,000 cubic feet in 1906 to 36,500,000 cubic feet in 1913, or 48.6 per cent.

In 1913 the export trade of timber and lumber and firewood amounted, in round figures, to 36,500,000 cubic feet, distributed by kinds as follows:

Classification	Cubic feet	Per cent
Planed lumber	14,700,000	40.1
Sawn lumber	12,000,000	32.9
Round timber	6,400,000	17.4
Hewn timber	2,400,000	6.7
Firewood and split wood	1,000,000	2.9
Total	36,500,000	100.0

More than half of the planed lumber goes to the British Isles, about one-third to Australia, and the rest to British South Africa and the Netherlands. Great Britain also takes nearly half of the sawn lumber (rough) and Belgium one-third, followed by Germany, Netherlands, and France. Over 90 per cent of the total export of round timber, consisting chiefly of props, goes to Great Britain. Most of the boxboards also go to Great Britain, as well as nearly four-fifths of the staves.

The Pulp Industry.—The growth of the pulp industry is truly phenomenal. On an average for 1908-12, 81,700,000 cubic feet of wood was used for the production of mechanical and chemical pulp and paper for export alone. This represents 20 per cent of the total cut.

The growth in the export of pulp and paper is shown in Table 125. The export of pulp and paper from Norway has increased many thousand fold in both quantity and value during the 50 years since 1870.

Other Wood-Using Industries.—Norway occupies a leading place among the nations of the world in the development of its wood-using industries. The water system favors the floating of logs. This operation is highly organized and much engineering work is done to improve the river courses. The floatable streams are open to public use by law. The lumber industry is one of the oldest in Norway, the first sawmills having been built about 1500. The industry has been greatly developed since the introduction of steam mills, but is now of secondary importance compared to the pulp and paper industries.

In 1909 there were 735 sawmills and planing mills, employing 12,702 laborers. The total output of rough and planed lumber, including firewood, was valued at $14,800,000 in 1909. The output of rough lumber was 47,498,000 cubic feet, and of planed lumber 28,723,000 cubic feet. Most of the large planing mills operated in connection with box factories. Planing mills also manufacture moldings, sash and doors, bobbins, clothes pins, barrel staves, and so on. Box manufacture is a well-developed industry in Norway. Spruce is the preferred wood, although pine is also used for this purpose if resin does not injure the contents of the box.

Forestry Movement.—Owing to the large number of small holdings the forests of Norway are to a large extent poorly managed, and the yield is much less than might be obtained under management if the holdings were in solid bodies. The public forests are under the Forest Service branch of the Department of Agriculture. It manages public forests and supervises laws and regulations affecting all forests.

The higher forest personnel is trained at the State College of Agriculture at Aas, near Christiania, established in 1897. A forest laboratory is being maintained in connection with the college. Private experimental stations and laboratories receiving official support have been maintained for some time in eastern Norway and on the west coast. There are in all 9 schools where forestry is being taught. Four of these are supported entirely by the state, while the other five are supported partly by the state and partly by the provinces in which they are located. They are largely for the training of the lower forest personnel.

The Norwegian Forest Association was established in 1898, and has about 11,000 members and 400 local branches in various parts of the country. Its purpose is to promote forest practice and the knowledge of forestry. Although it was established by private initiative, it received direct support from the government until recently. No other institution in Norway has contributed so much to the promotion of forestry as this association. Through its activities swamps have been drained and reforested. It gives advice to forest owners with regard to the management of their forests, maintains forest nurseries, and distributes planting stock at a very low cost. Large areas, especially in western Norway, have been reforested through the efforts of the association. It publishes a magazine for its members. During the 20 years of its activities close to 140 million trees have been planted and over 12,000 pounds of seed distributed, resulting in the reforestation of nearly 82,500 acres. Through its efforts nearly 133,000 acres of unproductive forest land have been reforested or drained during the last 20 years.

In addition to the Forest Association there is a Norwegian Forest Owners' Association. This is an organization of forest owners chiefly for the purpose of regulating the price of sawlogs.

Norway is one of the few countries in Europe where forest fire insurance is in existence. The Norwegian Mutual Forest Fire Insurance Company was established by some of the most prominent forest owners and showed a very rapid growth. The insurance covers chiefly young immature stands; mature stands cannot be insured. The insurance value must not exceed the market value of the insured trees. The rates of insurance in 1918 were as follows:

	Per cent
Forest located in districts having a fire patrol system	0.125
Forest located in districts not having a fire patrol system	0.175

In special cases extra premiums, usually not in excess of 0.5 of 1 per cent, may be charged. The company is a mutual fire insurance company in which the insured are the stockholders. Besides Norway, the Netherlands, Germany, Denmark, and Finland are the only countries which have forest fire insurance companies.

As a stimulus to the practice of forestry and for preventing forest devastation, the government grants timber holders loans on cheap terms against mortgage of forest lands and other similar property. This is to prevent timber owners from excessive cutting during hard times. The Norwegian Hypothecary Bank was established for this purpose in 1851. Loans amounting to three-tenths of the value of the forest based on the annual income are granted. The interest is considerably lower than the prevailing rate of interest charged by private banks, and is usually from 4 to 4½ per cent during normal times. These loans fall due in 47 years, and are payable in half-year installments.

Forest Laws.—Compared with Sweden and Finland, the laws for regulating cutting on private lands are lax and ineffective. In 1908 a law was passed concerning the cutting of private forests. Although the government shares in the expense of enforcing the regulations, it is left to each province to decide upon and establish rules for cutting. A number of counties and communes have adopted regulations with the object of preventing reckless cutting. These regulations are based chiefly on cutting to a diameter limit and apply only to timber for commercial purposes. The different communes and counties, however, have different regulations, and in a great many counties there are no laws at all governing cutting in private forests.

During the early part of the war, because of the great demand for timber from abroad, heavy cuttings took place in the Norwegian forests.

This caused a great deal of apprehension, and the government passed a law in 1916 that in all counties and communes where no previous regulations for cutting were established no timber having a smaller diameter than 8 inches breast-high should be cut. The result is that there is a variety of regulations in the different counties and communes of Norway. There is no state compulsory reforestation, and it is the general belief of the people in Norway that the present laws will not materially better the forests. Under these regulations the larger merchantable timber can be cut out and only defective trees left as the basis for future growth. The result can be nothing but gradual deterioration of the forest. In 1918 a law was passed making it compulsory on counties and communes to employ only trained foresters for the management of the county and communal forests.

Revenue.—The annual cut and the revenue in 1917 from public forests are shown in Table 126.

Table 126.—Revenue from Public Forests

Source	Cu. ft.	Net revenue	Net revenue per acre
Sold on stump:			
Sawlogs	4,756,851	$450,000	$0.200
Small dimension timber	270,539	31,000	0.014
Fuelwood	764,810	10,000	0.004
Sold after cutting:			
Sawlogs	3,610,308	422,000	0.188
Small dimension timber	97,534	6,000	0.003
Fuelwood	1,719,851	23,000	0.010
Miscellaneous	26,828	1,000	0.000
Total cut[1]	11,246,721	$943,000	$0.419

[1] Not including amount cut by peasants, landowners, etc., under special rights of usage. Corresponding figures for 1913:

Total cut (cubic feet)	7,227,428
Net revenue ($0.173 per acre)	$389,000

Taxation.—There is a small fixed tax based on the value of the forest property. The principal taxes, however, are levied on the cut of logs, usually about 10 per cent of the income derived from the sale of these logs.

Probable Future.—The forest situation in Norway is summarized in Table 127.

It is evident that Norway can no longer support an export industry of high-grade lumber. The lumber industry has long since been outstripped by the pulp and paper industry, which can operate with small-sized timber and in which close utilization of waste from logging and lumbering is possible. It is probable that Norway will in the future import a large share of lumber for domestic consumption and use wood from native forests to make pulp and paper. Although the bulk of lumber exported is relatively small, the exporters, acting in conjunction with the Swedish and Finnish exporters of lumber, know how to take advantage of the market. Of late years the cut has far exceeded the growth and it is not likely that the future annual output of lumber, rough and planed, for export will play an important part on the markets of the world.

On account of the unfavorable condition for further extension, the lumbermen have been forced to transfer their activities to other countries, particularly to eastern Europe and even Siberia. The future of the Norwegian lumber industry will depend upon the development of wood-using industries in Russia, from which country a large proportion of raw material for the Norwegian lumber mills has been obtained in years past.

TABLE 127.—NORWAY—SUMMARY OF FOREST SITUATION

Items	Total productive forest area	Public forests	Private forests	Total annual cut	Total annual net increment
	acres	*acres*	*acres*	*cu. ft.*	*cu. ft.*
Total......	14,065,000	2,873,100	11,191,900	432,000,000	320,500,000
Per acre....	....	....	....	30.7	22.8
Per capita..	5.3	1.1	4.2	164.1	121.8

Items	Excess of cut over increment	Average annual export	Average annual import	Domestic consumption
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*
Total......	111,500,000	133,400,000	12,400,000	311,000,000
Per acre....	7.9	9.5	0.9	22.1
Per capita..	42.3	50.7	4.7	118.1

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POLAND

Forest Area.—The present divisions of Poland are Congress Poland, formerly Russian territory; Galicia, formerly one of the Austrian crown lands; Prussian Poland, formerly belonging to Germany; and the Eastern Districts, including Bialystok, Nowogrodek, Polesia, and Volhynia—also originally Russian territory.

It has not yet been possible to collect and compile fully the official records of forest area and yield in the territories assigned to Poland at the close of the war. Hence the following figures given by the Ministry of Agriculture and State Domains are only estimates. The total forest area of Poland is about 21,881,000 acres, or 22.8 per cent of the land area.[1] This represents 0.86 acre per inhabitant. Only about 85 per cent of this area, however, is productive forest. (Table 128.)

Character of the Forest.—The principal timber species in Congress Poland is pine, which grows well in the poor soil, reaching large dimensions with a fine straight bole. In some sections there are forests of oak, though this species forms but a very small percentage of the whole forest. Other broadleaf trees are beech, aspen, ash, and maple. The largest forest area of Russian or Congress Poland is in the Governments of Lublin and Kielce, in the southern part of the district; the smallest is in Plock, Warsaw, and Kalisch, in the northwest. Beech is more abundant in the south than elsewhere in the district. Birch is widely distributed. Hornbeam and oak are present in greatest abundance in the south.

In the Eastern Districts, pine constitutes 47 per cent of the stand, oak 7 per cent, and all other hardwoods 46 per cent. The best oak timber is found in the Volhynia region, and pine is more abundant toward the north.

The forests of Galicia are not distributed uniformly. Thus eastern Galicia is largely prairie land, deficient in timber. Forests of beech and pine in natural stands are entirely lacking. The prevailing species in this prairie region are oak, hornbeam, and, less frequently, maple and basswood. Over most of Galicia the Baltic flora predominates, even in the

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[1] A more recent estimate (*Deutsche Forst-Zeitung*, Neudamm, May 21, 1922, p. 404) places the total forest area of Poland at 24,131,900 acres, distributed by provinces as follows:

	Area in acres
Congress Poland	5,856,370
Galicia	5,367,310
Posnania Pomerania	4,366,960
Eastern Districts	8,541,260
Total	24,131,900

This represents 25 per cent of the land area.

Carpathian mountains, except at high altitudes. In the valleys outside of the Carpathian mountains large forests are found in Opolia, Rostoch, Gologor, and Voroniak. Here broadleaf and coniferous species balance each other, but in the mountains conifers predominate. Of the broadleaf species beech occurs most frequently. The largest beech forests of former Austria were found in Galicia. Stands in which beech predominates occupy about 80 per cent of the entire area of hardwoods. Of conifers, pine, spruce, and fir predominate, while larch, yew, and juniper are

Table 128.—Forest Area of Poland

Districts	Total area	Population (without army)	Total forest area	Per cent of land under forest	Per capita forest area
Congress Poland:	*acres*		*acres*		*acres*
1. Warsaw	7,255,844	3,042,341	828,094	11.4	0.27
2. Lodz	4,694,159	2,225,655	713,514	15.2	0.32
3. Kielce	6,359,119	2,537,127	1,519,275	23.9	0.60
4. Lublin	7,698,401	2,090,040	1,624,482	21.1	0.78
Total	26,007,522	9,895,163	4,685,365	18.0	0.47
Eastern Districts:					
1. Bialystok	7,985,037	1,295,086	1,928,749	24.1	1.49
2. Nowogrodek	12,849,200	1,296,417	3,298,117	25.7	2.54
3. Polesia	10,514,105	865,035	2,704,680	25.7	3.13
4. Volhynia	8,828,883	1,501,511	2,060,359	23.3	1.37
Total	40,177,225	4,958,049	9,991,905	24.9	2.02
Galicia:					
1. Cracow	4,167,342	1,986,055	1,051,779	25.2	0.53
2. Teschen	....	145,241	50,334	....	0.35
3. Lemberg	6,677,383	2,724,327	1,684,896	25.2	0.62
4. Stanislawow	4,538,980	1,334,630	1,585,250	34.9	1.19
5. Tarnopol	4,012,905	1,419,355	677,926	16.9	0.48
Total	19,396,609	7,609,608	5,050,185	26.0	0.66
Prussian Poland:					
1. Posnania	6,543,361	1,970,822	1,180,107	18.0	0.60
2. Pomerania	4,027,342	941,461	973,576	24.2	1.03
Total	10,570,703	2,912,283	2,153,683	20.4	0.74
Grand total	96,152,059	25,375,103	21,881,138	22.8	0.86

found occasionally. The forests in the Carpathian mountains extend up to 5,000 feet above sea level—650 feet higher than the timber line in the Alps. Above that altitude the alpine flora begins. In 1920 conifers occupied 47 per cent, broadleaf species 27 per cent, and mixed stands 26 per cent. Of the entire forest area, 2,873,341 acres are worked on a simplified working plan, while 2,051,587 acres still remain unorganized. Seventy-nine per cent of the entire forest area is under high forest, managed on both a clear cutting and a selection system. Clear cutting is practiced on 1,276,316 acres and selection on 2,635,655 acres. Coppice with standards is practiced on 0.9 per cent and coppice on 20.1 per cent of the entire forest area. The value of the Galician forests is placed at $536,000,000.

Pine predominates in the forests of Prussian Poland. Oak is present in very small quantity, but no figures are available for the proportion of oak and other species for this region. The part of the district north and west of Posen, in West Prussia and Pomerania, contains the most abundant forests.

Character of Ownership.—Only 30 per cent of the timber land of Poland is in state ownership. The remainder, 70 per cent, is privately owned. By districts the forests are distributed according to ownership as shown in Table 129.

Annual Growth.—The annual growth in the forests of Poland, by districts, is estimated by the Ministry of Agriculture and State Domains as shown in Table 130.

The average annual growth for the entire forest area is 35.5 cubic feet per acre and 30.6 cubic feet per inhabitant.

For Galicia there are available more detailed figures regarding growth, different from those given in Table 130. The average annual growth in the high forests of Galicia before the war was 53.0 cubic feet per acre. For the entire area of high forest the volume was 207,695,000 cubic feet. Of this 55 per cent was saw timber and 45 per cent firewood. In coppice forests with standards the annual increment was 43 cubic feet per acre, or 1,906,000 cubic feet for the entire area of this kind of forests. Of this 27 per cent was saw timber and 73 per cent firewood. In coppice the average annual growth was 44.3 cubic feet per acre, or 43,120,000 cubic feet for the entire area of coppice forests. Of this 14 per cent was structural timber and 86 per cent firewood. The average growth for all the kinds of forests amounted to 51.4 feet per acre, or 252,721,000 cubic feet for the entire forest area. Of this 48 per cent was saw timber and 52 per cent firewood.

Annual Cut.—No figures are available for the present cut. According to estimates, however, when the industry is fully developed it can be maintained at 667,500,000 cubic feet, or about 30.5 cubic feet per acre per year. (Table 131.) In Galicia in 1910 the cut amounted to 105,619,718 cubic feet of saw timber. Of this, 10,463,802 cubic feet were hardwoods and 95,155,916 cubic feet softwoods. The cut of firewood amounted to 69,717,425 cubic feet; of this 34,880,650 cubic feet were hardwoods and 34,836,775 cubic feet softwoods.

Table 129.—Ownership of Polish Forests

District	State forests			Area under compulsory state administration	Private forests
	Forest area	Productive area	Per cent productive		
	acres	*acres*		*acres*	*acres*
Congress Poland:					
1. Warsaw	254,066	233,564	91.9	....	574,028
2. Lodz	198,565	179,185	90.2	....	514,949
3. Kielce	576,904	554,809	96.2	28,491	913,880
4. Lublin	238,019	221,135	92.9	....	1,386,463
Total	1,267,554	1,188,693	93.8	28,491	3,389,320
Eastern Districts:					
1. Bialystok	1,256,328	1,073,427	85.4	662	671,759
2. Nowogrodek	471,291	415,128	88.1	835	2,825,991
3. Polesia	866,419	482,453	55.7	....	1,838,261
4. Volhynia	647,886	443,127	68.4	1,213	1,420,260
Total	3,241,924	2,414,135	74.5	2,710	6,747,271
Galicia:					
1. Cracow	47,967	42,523	88.7	21,812	982,000
2. Teschen	....	....	....	50,334	....
3. Lemberg	64,814	61,516	94.9	1,189	1,618,893
4. Stanislawow	611,434	583,228	95.4	2,303	971,513
5. Tarnopol	....	....	....	974	676,953
Total	724,215	687,267	94.9	76,611	4,249,359
Prussian Poland:					
1. Posnania	531,544	493,318	92.8	....	648,563
2. Pomerania	777,013	760,528	97.9	....	196,563
Total	1,308,557	1,173,846	89.7	....	845,126
Grand total	6,542,250	5,463,941	83.5	107,812	15,231,076
Per cent	29.9	....	....	0.5	69.6

Domestic Consumption.—It is estimated that for the rebuilding of 215,000 residences and 645,000 other structures there will be needed 460,000,000 cubic feet. This building program, distributed over five years, will require 92,000,000 cubic feet per year. This, together with the normal domestic consumption of saw timber, of 120,000,000 cubic feet, makes a total consumption of saw timber of 212,000,000 cubic feet. The domestic consumption of firewood is estimated at 365,000,000 cubic feet, and the total domestic consumption of both sawlog timber and firewood is 577,000,000 cubic feet. The per capita consumption is 22.7 cubic feet. Of this 8.3 cubic feet is saw timber and 14.4 cubic feet is fuelwood.

TABLE 130.—POLAND—ANNUAL GROWTH ACCORDING TO OWNERSHIP

Districts	State forests	Forest under compulsory administration of state	Private forests	Total	Per acre	Per capita
	cu. ft.	*cu. ft.*	*cu. ft*	*cu. ft.*	*cu. ft.*	*cu. ft*
Congress Poland:						
1. Warsaw	9,888,107	...	16,421,320	26,309,427	31.77	8.65
2. Lodz	7,592,653	...	14,655,587	22,248,240	31.18	10.00
3. Kielce	31,430,054	1,200,698	32,666,067	65,296,819	42.98	25.74
4. Lublin	12,360,133	...	44,673,054	57,033,187	35.11	27.29
Total	61,270,947	1,200,698	108,416,028	170,887,673	36.47	17.27
Eastern Districts:						
1. Bialystok	52,972,000	28,252	21,541,947	74,542,199	38.64	57.56
2. Nowogrodek	12,713,280	35,315	70,629,334	83,377,929	25.28	64.31
3. Polesia	20,482,507	339,021	42,377,600	63,199,128	23.37	73.06
4. Volhynia	22,954,534	52,972	70,629,334	93,636,840	45.45	62.36
Total	109,122,321	455,560	205,178,215	314,756,096	31.50	63.48
Galicia:						
1. Cracow	3,037,061	1,094,755	31,783,200	38,810,819	36.90	19.54
2. Teschen	...	2,895,802	...	...	57.53	19.94
3. Lemberg	4,379,019	49,441	52,972,000	57,400,460	34.07	21.07
4. Stanislawow	38,846,134	116,538	35,314,667	74,277,339	46.86	55.65
5. Tarnopol	...	49,441	26,486,000	26,535,440	39.14	18.70
Total	46,262,214	4,205,977	146,555,867	197,024,058	39.01	25.89
Prussian Poland:						
1. Posnania	24,049,288	...	27,792,643	51,841,931	43.93	26.30
2. Pomerania	34,573,059	...	8,404,891	42,977,950	44.14	45.65
Total	58,622,347	...	36,197,534	94,819,881	44.03	32.56
Grand total	275,277,829	5,862,235	496,347,644	777,487,708[1]	35.53	30.64

[1] A more recent estimate places the annual growth at 1,129,600,000 cubic feet, or about 50 cubic feet per acre, altogether too high a figure. Of this 494,200,000 cubic feet, or 44 per cent, is saw timber and 635,400,000 cubic feet is fuel wood. (*Deutsche Forst-Zeitung*, Neudamm, May 21, 1922, p. 404.)

Exports.—A domestic consumption of 577,000,000 cubic feet leaves approximately 90,500,000 cubic feet of rough timber for export annually. It is doubtful if even such an amount could be maintained for a long time. Any greater export must mean either depletion of existing forests or keeping down the domestic consumption, which is low as it is. Most of the timber exported from Congress Poland and Galicia goes to Germany. Mine timber from Galicia is shipped to the Caucasus in increasing quantities, and construction timber is exported to Italy, France, and even to South Africa.

Between 1909 and 1911, the average annual export of wood from Congress Poland amounted to about 35,864,800 cubic feet, which was shipped abroad with the exception of a few thousand cubic feet to Russia. Of the total export, at least 25,416,000 cubic feet was rough timber. Nearly half of the sawlog timber of Galicia before the war was exported. Exports of rough timber from Galicia, however, were decreasing continually before the war, on account of rapid development of wood-using industries in that province. The value of the export of stock manufactured by these industries averaged $12,150,000 annually. Exports of sawn timber alone amounted to over 67,500,000 cubic feet.

Poland is well supplied with navigable and floatable waterways for transporting timber, including the Vistula and its tributaries, the Bug and the Narew. Canals connect the Bug with the Dnieper and the Narew

TABLE 131.—POLAND—POSSIBLE YEARLY OUTPUT OF THE FORESTS

Location	Area		Reported ready for yearly exploitation		Present number of sawmills	
	State	Private	State	Private	Number	Pre-war capacity (per yr.)
	acres	*acres*	*cu. ft.*	*cu. ft.*		*cu. ft.*
Eastern Districts (Vilna, Brest and Volhynia)[1]	3,244,634	6,747,271	102,413,500	247,202,669	102	35,314,667
Congress Poland	1,296,045	3,389,320	24,720,500	91,818,181	142	67,097,867
Galicia	800,826	4,249,359	31,783,500	134,195,735	304	124,025,111
Prussian Poland	1,308,557	845,126	15,891,750	19,423,067	327	186,814,588
Total	6,550,062	15,231,076	174,809,250	492,639,652		
Grand total	21,881,138		667,448,902		875[2]	413,252,233

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[1] Conservative private estimates indicate that there are only 2,648,600,025 cubic feet of standing timber now ready for exploitation in the districts of the East, of which 706,293,340 cubic feet is in state and 1,942,306,685 cubic feet in private forests. The yearly production of the Eastern districts based on a uniform exploitation of the above amounts over a period of 10 years would then be 70,629,334 cubic feet in state forests and 194,230,668 cubic feet in private forests.

[2] Damaged by war and not capable of operating at this capacity at present without repairs and replacement.

with the Memel. Danzig and Memel are shipping points for timber, part of which is sawed and otherwise converted. The smaller part of the export goes to the German ports of Stettin and Lubeck by way of the Baltic, the greater part to the Netherlands, Belgium, England, and France. Danzig is the principal export center for oak stavewood and railway ties, most of which are shipped to England.

For a time the Polish government attempted to control export of timber for the purpose of insuring the home supply. The result was stagnation in production, and the restrictions, which formerly applied to railway ties, telegraph poles, pulpwood, pit props, and aspen matchwood, were removed. The only restriction at present is on railway ties, of which a large number are needed in Poland for reconstruction of roads.

Wood-Using Industries.—The following table shows the present state of the wood industry in Congress Poland, Prussian Poland, and Galicia. Under "establishments" are included sawmills, carpenters' and coopers' works, veneer and furniture factories, etc.

	Number of establishments	*Number of workmen*
Congress Poland	879	17,259
Prussian Poland	7,084	30,350
Galicia	284 [1]	12,469
Total	8,247	60,078

[1] Evidently does not include water sawmills, of which there were 464 before the war.

One of the most important wood-using industries of Galicia is the lumber industry. In 1910 there were 124 steam and 464 water sawmills. These had 5,242 gang saws, 555 circular saws, and 30 band saws, besides planers. Another important industry is the manufacture of mechanical pulp. The five pulp plants before the war utilized 441,000 cubic feet of timber annually. Besides these industries there are also factories for bent-wood furniture, shoe lasts, excelsior, timber impregnation, and so on. The chief cause retarding the development of wood-using industries has been the high cost of transportation from Galicia.

The sawmills of the Eastern Districts were badly damaged during the constant fighting in this region. It will be necessary to reequip the mills and build new ones before manufacture can be undertaken on an important scale.

Danzig, at present the only seaport of Poland, is and will continue to be an important wood-industry center; 80 to 85 per cent of the wood shipped from Poland and Lithuania is worked up there. Before the war Danzig had 11 sawmills, but 20 new mills have been established recently and the output is one and one-half times greater than that of Congress Poland. In Congress Poland only a small amount (about 15 or 20 per cent) of the timber cut is worked up, owing to the high import duties levied by Germany on manufactured wood goods, which are six times as high as the duties on rough timber.

Prussian Poland is well equipped with sawmills, and may take over the manufacture of rough timber from those parts of the country in which there is a shortage of mills.

Basket making is an important industry of Poland. The demand for basket willow is so great that during the last few years attempts have been made to encourage planting of willow trees. The willow-preparing industry is also growing, and plans are now under way for the establishment of 10 steaming plants to supply raw material for baskets. The demand abroad caused the Ministry of Industry and Commerce to suspend export of willow until stock was taken of the resources, production, and consumption of this commodity.

Probable Future.—Poland possesses a forest wealth which, if properly handled, can produce sufficient timber for her own needs and possibly also a limited amount for export trade. Her normal consumption of less than 20 cubic feet per capita is much too low as compared with the consumption in the neighboring states. Even in pre-war times her consumption was greater. With further industrial development there is bound to come an increased domestic consumption and consequently a diminished amount available for export. With a per capita consumption of 25 cubic feet, which is about the average for Europe, there will be practically no timber for export if the forests are to be maintained in a continuously productive condition. There is danger that in Poland, as in all other newly created European countries, there may be overcutting as a result of the pressure for increased revenues from the forest.

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PORTUGAL

Until recently the prevailing idea was that Portugal is a deforested country. Recent statistics throw an entirely new light on the forest situation in that country.

Forest Area.—According to a compilation of statistics in the year 1913 by J. F. Borges, Chief of the Bureau of Forests, the total forest area of Portugal is 4,005,072 acres, or one-fifth of the total land area, and about 0.67 of an acre per capita of the population.

It is not known whether this figure includes the area of privately owned forest. Since these data were compiled, however, the forest area of Portugal has been further increased through planting by the government of many thousands of acres in coast and mountain regions, and by planting of maritime pine on private lands. The forest administration estimates that around 7,400 acres of waste land were planted to maritime pine by private individuals in 1913. An interesting indication of the increase in forest area is the growing demand for seeds of this species. It is therefore safe to estimate the present forest area of Portugal in round numbers as close to 5,000,000 acres, or 0.83 of an acre per capita. (Population 6,000,000 in 1911.)

Character of Ownership.—In 1907 the area of state forests was 86,887 acres, part of which consisted of young plantations in the mountains and on dunes. Since that time, however, the area of the state forests has been greatly increased by further afforestation. There are no available statistics on private and other ownership. It is known, however, that a large part of the land owned by the communes is not utilized for growing crops of any kind. Practically all the forests on such lands have been cut, burned, or destroyed by grazing. Very few of the communes have had sufficient funds to carry on afforestation on their own account, but the general interest in such projects is shown by the fact that the government receives many requests to undertake afforestation on communal lands.

Character and Distribution of the Forest.—The primeval forests of Portugal have disappeared so completely today that the indigenous species and the composition of the forests of earlier times can only be conjectured.

The forests are distributed by species at the present time approximately as follows:

	Acres	*Per cent*
Maritime pine	1,909,663	48
Evergreen oak	898,833	23
Cork oak	817,081	20
Chestnut	210,345	5
Deciduous oaks	169,150	4
Total	4,005,072	100

In addition to this about 1,137,000 acres are occupied by fig, olive, almond, and other fruit trees.

The valley of the Tagus River divides Portugal into two distinct zones of vegetation. To the south the country is level and the climate warm, with moderate rainfall. The chief species of this zone is evergreen or holm oak, which is used chiefly for fuel and charcoal, since it is too small and scrubby for any but the most simple building purposes. To the north the country is mountainous and maritime pine is the prevalent species. This is the most important tree of Portugal, forming nearly half of the forest area of the country. It grows up to 2,600 feet above sea level, reproduces itself readily from seed, grows rapidly, and is hardy. Hence it is a very valuable tree, not only for its resin and its wood, but also for its improvement of the soil. The treatment of maritime pine is simple. In the north, where property is broken up into very small parcels, and the soil is intensively cultivated, the litter is used as fertilizer. A sort of selection system is used, since this answers the requirements of the region most satisfactorily. Thinning is done very thoroughly, and natural reproduction begins as a rule at the age of twenty years. Twenty years later the owner cuts the stand clean. In the vicinity of large cities, owing to the high price of fuel, a similar treatment is used in connection with very intensive pruning. Such forests have an odd appearance, each tree being pruned to the fourth or fifth whorl from the top; but maritime pine withstands such treatment well, and the owner obtains a high profit from this form of management. In the government forests the rotation period is from 80 to 90 years. Maritime pine is not tapped for turpentine to any great extent in Portugal, and the process in use is crude and wasteful.

Cork oak is also a very important tree, covering about 20 per cent of the total forest area. The cork industry is one of the principal industries of Portugal, and one of the chief sources of national revenue. The average annual production of cork is over 176 million pounds, of which 88 million pounds is exported, a large share to the United States. This is one-half of the total world production of cork. *Pinus pinea* is also widely distributed in Portugal, but is exclusively a planted tree, and is rarely found in large stands. Chestnut is native to this region, is fairly abundant, and is important chiefly for its fruit, which is used as food by the natives and also exported. The timber is too small to be of great value commercially.

The moderate climate of Portugal makes it possible to cultivate many exotic species, the most successful of which are the species of *Eucalyptus* and *Acacia melanoxylon*. The former grow very rapidly, and soon reach large dimensions; as the wood warps in drying, however, it is not being readily accepted for industrial purposes. Acacia, which also grows rapidly, is much in demand.

Annual Cut.—There are no official figures for the annual cut of wood in Portugal. It is estimated roughly that 26 million cubic feet, not including fuel, is being cut annually. The annual consumption of fuel has been estimated at about 10 million tons. This is evidently too high a figure, as it would bring the total annual cut, even at 50 cubic feet to the ton, to over 500 million cubic feet. This for the entire area of only

5 million acres would mean a cut in excess of 100 cubic feet per acre. Considering that forestry in Portugal is of very recent origin and that a large area is still under young plantations, the annual cut cannot be more than 25 cubic feet and is more likely to be 20 cubic feet per acre; or from 100 to 125 million cubic feet for the entire area, of which 26 million cubic feet is sawlog material and 74 to 99 million, or 74 to 79 per cent, fuelwood and mining timber.

Annual Growth.—In view of the fact that large areas are being planted in Portugal and better care is being taken of the existing forests, the annual growth over the entire area may be regarded as equal to the amount cut, i. e., 20 cubic feet, or possibly even 25 cubic feet per acre. For the total forest area this would represent a growth of from 100 to 125 million cubic feet.

Exports and Imports.—If the value alone is considered, Portugal is an importer of timber. Thus in 1913 the value of all imports of wood amounted to nearly 2 million dollars, while the exports amounted to one million dollars. The reason is that Portugal imports chiefly high-priced hardwoods and heavy building timber, while the exports are largely in the form of mine timbers and cheap lumber. If the volume of imports and exports is considered, however, Portugal is a timber exporting country. The excess of exports over imports may, on an average, amount to about 20 million cubic feet. This is clearly brought out in Table 132, showing the imports and exports for 1912 and 1913, the last two years before the war.

The chief article of import is lumber, which comes mainly from the United States and the Baltic region. The United States also supplies a large proportion of white oak staves used in Portugal for the port wine trade. Portugal is well supplied with small timber, chiefly maritime pine, and is able to export considerable amounts in the form of mine timbers and cheap lumber. In 1913 the export of rough timber amounted to over 18 million cubic feet, consisting almost entirely of mine timbers sent to England and Wales. Portugal also supplies Spain with large quantities of mine timber.

Domestic Consumption.—With an annual cut of 100 to 125 million cubic feet and an excess of exports over imports of about 20 million cubic feet, the normal consumption of wood in Portugal may be placed at from 80 to 105 million cubic feet a year. This, with a population of six million people, amounts to about 13 to 17½ cubic feet per inhabitant. Of this about 20 million cubic feet, or about 3 cubic feet per capita, is sawlog material.

Forest Legislation.—The present system of forest management in Portugal is based on the law of Dec. 24, 1901, and a supplementary decree dated Dec. 24, 1903. To these excellent laws, drawn up by enthusiastic and capable men, is due in large measure the rapid progress of forest organization in Portugal during the last 20 years. Some of the principal features of the law are:

1. All receipts from government forests go into a fund to be used exclusively for forestry purposes. Since a considerable sum is obtained in this way, sufficient money is left after paying all expenses to carry on afforestation work and road building in mountain regions, and for stabilizing dunes.

2. All forests belonging to communes, parishes, and public establishments, as well as waste lands which are not suitable for agriculture

TABLE 132.—PORTUGAL—IMPORTS AND EXPORTS OF WOOD

Imports	1912	1913
	cu. ft.	cu. ft.
Fuelwood (from Spain)	150,067	110,192
Rough timber	454,978	414,005
Wood in planks	2,496	2,174
Common wood:		
Beams	122,350	434,543
Boards over 75 mm. thick	625,975	439,626
Sawn boards	1,275,001	1,138,990
Manufactured wood	8,685	10,078
Sawn wood unclassified	2,414	1,802
Box shooks	15,592	14,956
Timber not specified	10,570	14,822
Total	2,668,128	2,581,188

Exports	1912	1913
	cu. ft.	cu. ft.
Fuel (to Spain)	109,531	20,480
Rough timber	12,715,831	18,123,538
Beams	1,078,968	1,761,144
Wood for telegraph posts	17,095	11,890
Wood in strips	1,251,985	2,420,521
Boards (planks)	3,033,549	2,809,218
Stringers and crossties	241,877	191,757
Wood for toothpicks	11,195	10,541
Timber not specified	76,323	74,687
Total	18,536,354	25,423,776

but can be profitably planted to trees, are set aside for planting and placed under the control of the forest service. These lands include extensive areas in the mountains and on the coast.

3. All state forests and reservations (there are very few communal forests) and also all private forests located in regions destined for afforestation are under compulsory control of the forest service under penalty of expropriation; while for private owners of forests outside such areas submission to this control is optional.

A further law enacted May 23, 1911, established an export tax of 14 cents per ton of pitwood, and specifies that 70 per cent of this revenue shall be used for a fund for forest inspection and for annual prizes to be given to teachers in elementary schools who have done the greatest service in forestry instruction and in the organization of silvicultural societies.

Forestry Movement.—In 1922 the agricultural service was reorganized, dividing the country into forest zones and agricultural districts. Each district contains an agricultural school, the purpose of which is to study local conditions, carry on experiments, and teach the peasants by object lessons. These schools offer a wide field for the activities of forest officials.

The reorganization of the administrative system has given a decided impetus to public interest in forestry. Since 1901 nearly 1,500 acres of uncultivated land have been planted with forest trees every year, part in the mountains and part on the dunes, and mountain roads have been laid out, opening up inaccessible regions to travel and giving employment to large numbers of the inhabitants.

The government furnishes trees free of charge to communities for planting streets, parks, and squares, and also supplies private individuals whose forests come within the provisions of the forest law. Government forest officials are at the service of communities and individuals for advice in planting and caring for their trees. There is also an association for tree culture, the membership of which is increasing very rapidly, and which is beginning to play an important role in the forest policy of the country. But the increasing interest in forestry matters is by no means to be attributed exclusively to government propaganda. The causes are rather of an economic character. The increase of railways and roads, the constantly growing demand for wood for industrial purposes, the export of mine timbers to England, and the extension of the turpentining industry, are the main reasons for adding to the forest area of the country.

Forestry does not receive the same aid from the communities as from the state, since most of their citizens lack understanding of the principles of tree culture, and the large number of illiterates in agricultural communities makes it exceptionally difficult to distribute such information. Nor have the communities the means, in most cases, to carry on afforestation, even if they could be persuaded to set aside a part of their goat and sheep pastures for such a purpose. With few exceptions, all the land property of the communities, covering an estimated area of 5 million acres, consists of almost entirely unproductive pasture, on which there are neither houses nor barns, neither crops nor forest.

Since 1904 only a few communities and public institutions have been able to include disbursements for forestry purposes in their estimates. On the contrary, the number which have appealed to the government to plants trees on their property is gradually increasing. The forest law was generally well received by the private forest owners, including owners whose property is destined for planting. This was due chiefly to the fact that hunting rights were granted to these owners, and that supervision of their property was taken over by the state.

On the whole, the outlook for the future of forestry in Portugal, judging from what has already been accomplished and by the present energetic trend of the movement, is extremely favorable. The principal task now before the government is afforestation of about 2½ million acres of waste land, including 89,000 acres of shifting sand. Little can be accomplished in this direction at present, however, because of the lack of sufficient appropriation in the budget and the hostility of the mountaineers to all improvement projects. There is still a large field for future activity.

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RUMANIA

Forest Area.—The total area of the new kingdom of Rumania, as fixed by the treaties of 1919, is 78,260,500 acres, and the population about 17,500,000. By the terms of the treaties Rumania received Transylvania, Bukowina, and Marmaros, formerly provinces of Austria-Hungary; Bessarabia, formerly belonging to Russia; and a portion of the Banat district. According to Hungarian statistics for 1917 the territory of Transylvania contains 10,180,000 acres of forest, 84 per cent of which is dense forest. The forests of Bessarabia cover 653,500 acres, or 6.2 per cent of the total area; those of Marmaros cover 1,377,000 acres, or 48.6

per cent; Bukowina contains 1,081,000 acres of forest, or 43 per cent of the total productive land area; and the Banat about 1,615,000 acres. This, together with the forest area of old Rumania, 6,850,000 acres, makes 21,758,000 acres, approximately 27.8 per cent of the total area, and a little over 1.2 acre per capita of the population.[1]

Character of the Forest.—Softwoods occupy about 30 per cent of the total forest area of old Rumania, hardwoods 50 per cent, and mixed species 20 per cent. Broadleaf species are by far the most abundant. in Transylvania 24 per cent of the forests is occupied by oak, more than half (53 per cent) consists of other deciduous trees, and conifers make up the remaining 23 per cent. In Bukowina 25 per cent of the forests are broadleaf and 75 per cent conifers. For the country as now politically constituted broadleaf trees form 76 per cent and conifers 24 per cent of the forests.

The surface of the country is divided into three perfectly distinct regions, characterized by their vegetation: the high mountains, the hill region, and the plains region.

The summits of the high mountains are generally treeless. There are extensive areas of pasture, which furnish food for vast herds of cattle during the summer. Just below the pastures, *Pinus mughus* grows in the more sheltered places, covering fairly large areas. This is the beginning of forest vegetation. Lower down, between 6,850 and 5,525

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[1] Since these figures were worked up more recent figures, which seem more accurate, have become available (*Deutsche Forst-Zeitung*, Neudamm, May 21, 1922, pp. 403, 404). The forest area of New Rumania is given as 18,052,440, distributed according to species, among the different provinces as follows:

TABLE 133.—FOREST AREA OF RUMANIA

Division	Conifers	Oak	Other hardwoods	Total
	acres	*acres*	*acres*	*acres*
Bukowina	825,530	....	288,990	1,114,520
Marmaros	521,390	241,550	896,520	1,659,460
Transylvania:				
Siebenburgen	1,837,600	982,980	2,739,290	5,559,870
Crisana	37,620	716,760	693,390	1,447,770
Banat	32,830	469,720	1,007,920	1,510,470
Old Rumania	1,129,530	1,443,150	3,571,770	6,144,450
Bessarabia	....	307,950	307,950	615,900
Total	4,384,500	4,162,110	9,505,830	18,052,440
Per cent	24.3	23.0	52.7	

feet above sea level, Norway spruce occurs in fine large stands, unmixed with other species. These forests are still virgin in certain parts of the mountains, being very difficult of access. Still lower is fir, scarce at first but becoming more abundant at lower altitudes. It grows together with

Table 134.—Area of Forests of Old Rumania, by Ownership

Department	Government forests[1]	Domanial and crown forests	Municipal and corporation forests	Private forests	Total forest area
	acres	*acres*	*acres*	*acres*	*acres*
Arges	167 000		42,000	148,000	357,000
Bacan	156,000		17,000	337,000	510,000
Botosani	20,000		2,000	99,000	121,000
Braila	19,000		2,000	4,000	25,000
Buzcu	92,000		5,000	164,000	261,000
Constantza	71,000		16,000		87,000
Covurlui	16,000			56,000	72,000
Dambovitza	113,000		9,000	151,000	273,000
Dolj	93,000	14,000	12,000	62,000	181,000
Dorohoi	13,000		7,000	74,000	94,000
Flaciu	29,000		2,000	33,000	64,000
Gorj	114,000		14,000	445,000	573,000
Ialomitza	34,000		3,000	21,000	58,000
Iassy	43,000		4,000	67,000	114,000
Ilfov	65,000	7,000	7,000	43,000	122,000
Mehedintze	104,000		6,000	227,000	337,000
Muscel	184,000		6,000	177,000	367 000
Neamtz	373,000	31,000	4,000	125,000	533,000
Olt	23,000		3,000	54,000	80,000
Prahova	107,000	8,000	71,000	124,000	310,000
Putna	75,000		9,000	263,000	347,000
R.-Sarat	50,000		2,000	105,000	157,000
Roman	15,000		8,000	60,000	83,000
Romanatz	33,000	1,000	11,000	25,000	70,000
Suceava	77,000	100,000		181,000	358,000
Tecuci	27,000			61,000	88,000
Teleorman	26,000		4,000	24,000	54,000
Tulcea	263,000		23,000	2,000	288,000
Tutov	29,000		3,000	58,000	90,000
Vaslui	25,000	12,000	10,000	59,000	106,000
Velcea	133,000		4,000	398,000	535,000
Vlasca	88,000		6,000	41,000	135,000
Total	2,677,000	173,000	312,000	3,688,000	6,850,000

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[1] Of this total, 404,000 acres, or 15.1 per cent, are classified as *blank*, leaving 2,273,000 acres, or 84.9 per cent, of actually forested area.

spruce, but only up to 3,250 feet altitude. Beech appears almost simultaneously with fir, and these two species constitute the entire forest below 3,250 feet altitude, the first species becoming more and more rare and giving place to beech, which finally forms vast pure stands. On southwest slopes, beech occurs as high as 3,900 feet above sea level, either pure or mixed with a few conifers. Other species, such as *Pinus cembra, Larix sibirica, Taxus baccata,* and *Acer pseudoplatanus,* are found only sporadically. Birch (*Betula alba*) forms clumps on the detritus cones and in the valleys, and fir and spruce eventually become mixed with the beech. *Pinus sylvestris* is also present in the form of heavier groups at the foot of the mountains.

The Hill Region.—This region begins below an altitude of 2,600 feet. In the higher portion is beech, nearly or quite pure. It is mixed with sessile oak on the exposed southwest slopes, and in this case the oak is usually found in clumps. Farther down the hills sessile oak becomes more abundant and beech more rare; beech is found after that only in the bottoms of the valleys, becomes mixed with hornbeam, and finally disappears. *Quercus robur* and *Quercus conferta* then make up the forest growth, unmixed with other species; pedunculate oak appears sporadically in the valleys, at the foot of the hills.

The Region of the Plains begins at about 1,060 feet above sea level. It is characterized by stands of pedunculate oak, pure or mixed with ash and *Quercus cerris.* Here are also found forests of very special composition, in which pedunculate oak, field maple (*Acer tataricum*) linden, hornbeam, elm, *Sorbus,* aspen, and turkey oak grow side by side, in such mixture that all the species may be found within an area of a few acres. These forests have been badly devastated by indiscriminate cutting and by grazing.

From the standpoint of their importance in the composition of the forests, the species may be arranged in the following order: beech; oak and its varieties; spruce; fir; other species, such as linden, hornbeam, ash, elm, etc. Beech covers the largest wooded area in Rumania.

Character of Ownership.—In old Rumania 39.1 per cent is state forests, 2.5 per cent domanial and crown forests, 4.6 per cent municipal and corporation forests, and 53.8 per cent private forests. In Bukowina the state owned 51.1 per cent, the communes 12.9 per cent, and private individuals 36.0. In Transylvania state ownership predominates, while in Bessarabia out of the 653,000 acres 4.1 per cent belong to the state and the remainder, 95.9 per cent, to private owners. (Table 134.)

Old Rumania may therefore be characterized as a country in which private ownership of forests predominates. A great deal of that owner-

Table 135.—Character of Forest Ownership

Division	State, etc.		Private		Total
	acres	*per cent*	*acres*	*per cent*	*acres*
Transylvania	7,033,000	69.1	3,147,000	13.8	10,180,000
Bukowina	691,840	64.0	389,160	36.0	1,081,000
Bessarabia	26,773	4.1	626,227	95.9	653,000
Old Rumania	3,165,000	46.2	3,687,000	53.8	6,852,000
Total	10,916,613	58.2	7,849,387	41.8	18,766,000
Marmaros	....	....	....	....	1,377,000
Banat	....	....	....	....	1,615,000
Grand total	....	....	....	....	21,758,000

ship is in the form of large timber holdings. In Rumania as it has now been organized, the state owns 16.8 per cent of all the forests, communes and districts 24.1, public institutions 9.9, and individuals 49.2 per cent.

For new Rumania it seems that state forests slightly predominate. Under state forests are included domanial and crown forests and municipal and corporation forests, that is, everything not privately owned.

Exports and Imports.—The following figures show the increase in the wood trade of Rumania in the 20 years from 1890 to 1910:

Year	Exports		Imports	
	Amount	Value	Amount	Value
	cu. ft.		*cu. ft.*	
1890	....	$ 530,750	2,880,976	$1,599,005
1900	....	2,412,500	916,608	1,036,024
1901	....	3,474,000	....	....
1903	15,831,200	4,446,720	425,880	466,867
1906	23,895,200	5,506,618	4,505,200	1,848,940
1907	21,403,200	4,895,445	4,172,000	1,714,805
1908	23,632,000	5,110,254	3,220,000	1,943,896
1909	26,528,880	5,683,001	3,494,400	1,884,259
1910	22,232,000	4,861,670	2,716,000	2,016,271

The amounts and values of the exports and imports of wood and wood products from 1906 to 1910, by countries of origin and destination, are given in Table 136.

Rumania acquired an especially valuable forest resource in Bukowina. Before the war Bukowina exported large quantities of wood to other crown lands of Austria and Hungary. Thus in 1908, 36,410 tons of industrial timber were shipped to these provinces and 397,000 tons to foreign countries. Most of the wood destined for foreign trade was transported on floatable streams, and passed through Russia or Rumania to the sea or by rail directly to the adjoining or more distant countries. Timber was shipped by rail to Germany and Russia, on the Bistritz River to Rumania, and on the Pruth to Russia and Rumania. The greater part of the better grade of timber was shipped via Galatz or Odessa, the harbor of Odessa being preferred on account of its better equipment. The wood then went by sea to the Orient, the Mediterranean countries, and the North Sea region. Very little wood is now floated on the San and the Vistula. Germany, Switzerland, Italy, France, Russia, and the Netherlands, and also the Levant (Egypt, Syria, Constantinople, and Greece) were all importers of wood from Bukowina. The total value of the export of wood in 1905 was about $3,755,500, and in 1908 the export of industrial timber was $3,024,700. Wood and wood articles form the principal item of the export trade of Bukowina.

Annual Growth and Cut.—The annual yield capacity of the forests of new Rumania is estimated at 370,650,000 cubic feet, or 17.0 cubic feet per acre, but owing to the almost inaccessible location of much of the forested land and the lack of good roads and navigable streams and rivers, great areas of forest have been unexploited up to this time. The coniferous forests belonging to the state are to a great extent unutilized, because of lack of funds. These forests contain spruce trees measuring 130 to 190 feet in height and 3 feet in diameter, breast high. The annual cut, therefore, can not be more than 301,800,000 cubic feet, of which half is saw-timber.

Before the war Rumania not only supplied its own timber requirements but also exported annually in excess of imports about 20,000,000 cubic feet of hewn and sawn timber and lumber, most of which went to Turkey and the Mediterranean countries.

Domestic Consumption.—About 282,400,000 cubic feet of wood, or a little over 16 cubic feet per capita, are required annually for domestic use, leaving 88,250,000 cubic feet for export if the forests were utilized to the full capacity.

Forest Legislation.—In 1881 Rumania passed a forest law according to which the state and municipal forests, and also forests belonging to public bodies and to churches, are placed under management and cut according to an authorized plan. In addition, forests in mountain regions, as well as those which serve to protect dams, frontiers, railways, and highways, or to fix the banks of streams, are placed under forest management and are supervised by government foresters. The law provides for a technical forest council, which exercises control over all matters pertaining to forests under management. It approves or changes methods

TABLE 136.—EXPORTS AND IMPORTS OF WOOD—RUMANIA

Exports, by Countries of Destination

Country	Amount					Value				
	1906	1907	1908	1909	1910	1906	1907	1908	1909	1910
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*					
Austria-Hungary	8,232,000	6,753,600	10,096,800	10,724,000	8,528,800	$1,253,535	$ 981,984	$1,462,747	$1,401,759	$1,193,126
Holland	4,883,200	4,233,600	3,119,200	3,696,000	3,180,800	1,351,386	1,173,633	860,201	1,018,654	877,571
Turkey	2,697,520	2,447,200	2,570,400	2,452,800	2,083,200	763,508	688,817	715,837	694,800	577,070
Italy	2,312,800	1,276,800	1,999,200	3,841,600	2,072,200	638,444	343,154	567,034	1,060,921	557,963
Bulgaria	1,355,200	1,265,600	1,624,000	1,758,400	1,948,800	324,433	291,044	297,413	374,227	443,707
Egypt	436,800	1,568,000	1,075,200	638,400	1,674,400	128,152	434,829	297,220	176,595	462,235
France	1,276,800	1,394,400	1,383,200	1,159,200	778,400	394,106	445,251	495,431	376,157	229,284
Russia	728,000	868,000	554,400	330,400	263,200	70,252	83,569	52,496	26,055	25,669
Greece	369,600	285,600	308,000	386,400	560,000	116,186	86,850	93,798	110,782	157,295
Germany	61,600	78,400	106,400	33,600	50,400	24,318	29,915	24,897	22,967	20,265

Imports, by Countries of Origin

Country	1906	1907	1908	1909	1910	1906	1907	1908	1909	1910
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*					
Austria-Hungary	3,847,200	2,889,600	2,329,600	2,693,600	1,853,600	$832,023	$686,694	$733,786	$799,599	$830,286
Germany	67,200	67,200	89,600	61,600	84,000	425,179	360,717	396,229	314,783	410,704
France	33,600	44,800	89,600	106,400	56,000	130,275	150,926	296,448	410,897	218,669

of management, settles questions about clearings, etc. In short, it is the highest authority in all technical matters.

Probable Future.—The forest protection law of 1881 is more or less a dead letter. The state, a large forest owner, has usually lacked funds for the proper development and protection of its forests. Still the state forests, as well as those of the larger timber holders, are said to be in fairly good condition. Smaller forest holdings, on the other hand, are badly devastated. Legislation has not served to check the destruction of such forests, and hundreds of thousands of acres are now treeless which 40 years ago were covered with mature timber. Even those forests which escaped cutting were badly injured by fires and other causes. Old Rumania, therefore, is comparatively poor in valuable commercial timber. Experts estimate that the wood supply will be exhausted in 10 to 15 years, since little care has been taken to reforest the cut-over land. Oak is getting very scarce and beech has taken its place as the principal species. Attempts at the reforestation of denuded areas have heretofore encountered great opposition, especially among peasant owners. The government has undertaken systematic reforestation in various parts of the country, however, and rational exploitation as a policy was constantly gaining ground before the war. The present forest area of Rumania is three times that of old Rumania. Such territories as Transylvania and Bukowina have added enormous forest wealth, and with reasonable care Rumania can for a long time be a timber-exporting country on a comparatively large scale. Together with Jugo-slavia and Czechoslovakia, it will assume the place of provider of wood for western Europe which before the war was held by the Austrian Empire.

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RUSSIA

Forest Area.—The total forest area of European and Asiatic Russia is estimated to be in the neighborhood of 1,582,000,000 acres, exclusive of Finland, Esthonia, Latvia, Poland, Lithuania, and Bessarabia. This area is distributed about as follows:

Division	Acres	Per cent of total
European Russia	440,000,000[1]	27.8
Caucasus	18,500,000	1.2
Asiatic Russia	1,083,500,000	68.5
Turkestan	40,000,000	2.5
Total	1,582,000,000[2]	100.0

[1] Since the revolution of 1917, out of the territories of the former Russian Empire there were created several independent states—Esthonia, Latvia, Lithuania, and Poland. In addition, Rumania absorbed Bessarabia. As a result of this territorial loss, the forest area of European Russia has decreased by 15,353,700 acres, not included in the above figure, as follows:

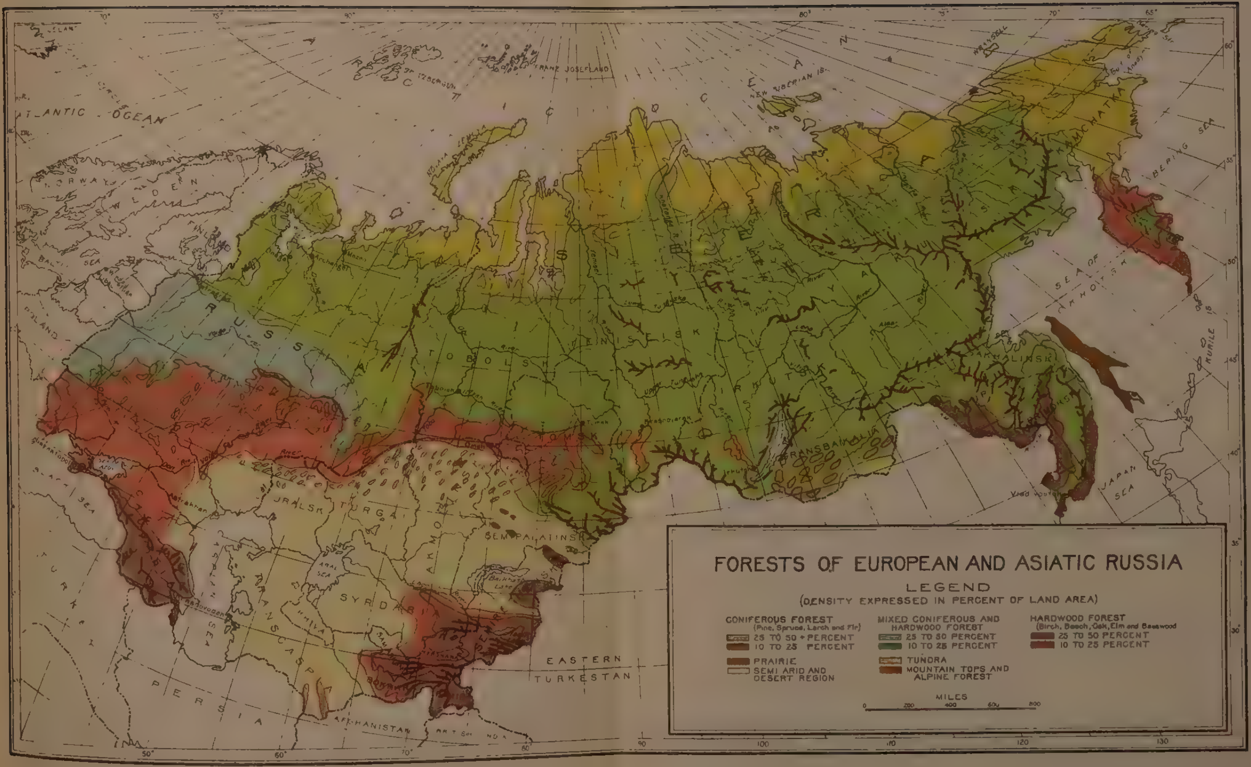
	Acres
Esthonia and Latvia	5,004,500
Lithuania	4,466,500
Poland	5,230,200
Bessarabia	652,500
Total	15,353,700

[2] According to Prof. J. Y. Simpson (London Geographical Journal, June, 1918, p. 371) who quotes Russia's State Controller of Finance in 1916, this area may even approximate 2,200,000,000 acres, although a certain percentage of it may not be immediately accessible.

Not all of this land is actually commercial forest. Much of it is swamp, lakes, large burns, and other waste land. In European Russia about 83 per cent of the total classed as forest is productive; in Caucasus, 63 per cent; and in Asiatic Russia, as far as its forests have been explored, under 50 per cent. On this basis the forest-bearing land in European and Asiatic Russia must be in the neighborhood of 872,000,000 acres, distributed as follows:

Division	Productive forest	Per cent of forest area
	Acres	
Siberia	492,700,000[1]	45.5
European Russia	367,291,000	83.5
Caucasia	11,655,000	63.0
Total	871,646,000	56.5

[1] Productive area of state forest.


FORESTS OF EUROPEAN AND ASIATIC RUSSIA
LEGEND
(DENSITY EXPRESSED IN PERCENT OF LAND AREA)
CONIFEROUS FOREST
(Pine, Spruce, Larch and Fir)
25 TO 50 + PERCENT
10 TO 25 PERCENT
MIXED CONIFEROUS AND HARDWOOD FOREST
25 TO 50 PERCENT
10 TO 25 PERCENT
HARDWOOD FOREST
(Birch, Beech, Oak, Elm and Basswood
25 TO 50 PERCENT
10 TO 25 PERCENT
PRAIRIE
SEMI ARID AND DESERT REGION
TUNDRA
MOUNTAIN TOPS AND ALPINE FOREST
MILES
0
200
400
600
800
ATLANTIC OCEAN
ARCTIC OCEAN
NORWAY
SWEDEN
FINLAND
BALTIC SEA
POLAND
RUSSIA
FRANZ JOSEFLAND
NOVAYA ZEMLYA
NEW SIBERIAN IS.
SIBERIA
TOBOLSK
YENISEISK
YAKUTSK
IRKUTSK
TOMSK
TRANSBAIKALIA
KAMCHATKA
BERING SEA
SEA OF OKHOTSK
KURILE IS.
JAPAN SEA
Vladivostok
SEMIPALATINSK
TURGAI
URALSK
AKMOLINSK
SYR DARYA
TRANSCASPIA
ARAL SEA
Baikhash Lake
Astrakhan
BLACK SEA
CASPIAN SEA
TURKEY
PERSIA
AFGHANISTAN
EASTERN TURKESTAN
Archangel
Volga
Don
Obi
Yenisei
Lena
Amur
50°
60°
70°
80°
90
100
110
120
130

EUROPEAN RUSSIA

The present territory of European Russia is 1,137,963,520 acres. Therefore the 440,000,000 acres of forest land form 38.7 per cent of the land area, and the 367,291,000 acres of productive forest area 32.3 per cent. With a population recently given as 100,000,000 (estimated), this is 3.7 acres of productive forest area and 4.4 acres of total forest area per capita.

The distribution of the forests by the different provinces is shown in Table 137.

Character of the Forest.—According to species and character of the stands, the forests of European Russia may be divided into three broad regions:

1. The northern coniferous forest.
2. The mixed coniferous and hardwood forest.
3. The hardwood forest of the prairie region.

1. *The northern coniferous forest.*—In the central portion of northern Russia coniferous forests of pine (*Pinus sylvestris*) and spruce (*Picea excelsa*) form the predominant type. In the eastern part of the Province of Archangel and in the Ural Mountains, European larch (*Larix decidua europaea*), which differs very little from western European larch, forms vast forests.

2. *Mixed coniferous and hardwood forest.*—The mixed coniferous and hardwood forest is confined to the central western provinces and is made up of Scotch pine, spruce (*Picea excelsa*), larch, European fir (*Abies pectinata*), oak (*Quercus pedunculata*), basswood (*Tilia parvifolia*), maple (*Acer platanoides*), ash (*Fraxinus excelsior*), hornbeam (*Carpinus betulus*), and beech (*Fagus sylvatica*).

3. *The hardwood forests of the prairie region.*—The hardwoods of the prairie region in European Russia are confined to the southern provinces and are made up of oak (*Quercus pedunculata*), maples (*Acer platanoides, A. campestre,* and *A. tataricum*), ash (*Fraxinus excelsa*), basswood (*Tilia parvifolia*), elms (*Ulmus effusa, U. montana, U. campestris,* and *U. suberosa*), and poplar. The only conifer is Scotch pine, which occasionally forms stands on sandy soils near rivers. The forests most characteristic of the prairie region are oak.

In European Russia conifers occupy about 88 per cent and hardwoods 12 per cent of the forest.

Character of Ownership.—Since the revolution of 1917 all land, including forest land, has been nationalized. The distribution of the forests according to ownership before the revolution is given in Table 138.

Nearly 70 per cent of all forests belonged to the state. The government-owned forest land in European Russia was very unequally dis-

TABLE 137.—FOREST AREA—EUROPEAN RUSSIA

Province	Forest area	Per cent of land under forest	Forest area per capita
	acres		*acres*
Archangel	86,647,300	44.6	171.3
Astrakhan	510,600	3.4	0.4
Chernigov	1,826,600	15.3	0.6
Don	842,800	2.1	0.2
Grodno	2,097,900	23.6	1.0
Kaluga	2,100,200	28.0	1.4
Kazan	4,646,700	30.2	1.6
Kharkov	1,124,100	8.6	0.3
Kherson	292,000	1.6	0.1
Kiev	1,994,300	16.3	0.4
Kostroma	9,419,700	46.6	5.1
Kursk	617,700	5.5	0.2
Minsk	8,473,700	40.7	2.8
Moghilev	3,201,200	28.3	1.3
Moscow	2,210,200	27.7	0.6
Nizhny-Novgorod	4,697,000	38.2	2.3
Novgorod	14,669,000	53.9	8.5
Olonets	15,477,300	47.6	32.5
Orel	2,092,500	18.7	0.7
Orenburg	6,838,700	15.1	3.0
Penza	1,674,600	18.1	0.9
Perm	46,102,100	57.3	11.3
Petrograd	5,131,500	50.2	1.6
Podalea	1,042,800	10.4	0.3
Poltava	575,800	5.0	0.1
Pskov	2,897,700	29.0	2.0
Ryazan	2,033,600	20.1	0.7
Samara	2,822,600	7.6	0.7
Saratov	2,404,200	12.7	0.7
Simbirsk	3,342,600	28.7	1.6
Smolensk	3,194,700	24.5	1.4
Tambov	2,595,700	16.2	0.7
Taurida	1,125,700	7.7	0.5
Tula	614,600	8.3	0.3
Tver	3,656,700	24.1	1.5
Ufa	7,254,800	25.0	2.3
Vitebsk	2,681,000	25.9	1.4
Vladimir	3,162,400	27.8	1.4
Vologda	80,682,600	81.8	19.0
Volhynia	4,704,100	28.3	1.1
Voronezh	1,179,200	7.4	0.4
Vyatka	15,501,300	41.1	3.8
Yaroslav	2,543,000	30.7	0.6
Yekaterinoslav	588,200	3.8	0.2
Total	367,291,000	32.3	3.7

TABLE 138.—CHARACTER OF OWNERSHIP

Ownership	Acres	Per cent
State	245,282,700	66.8
Private	87,501,700	23.8
Peasant	28,518,900	7.8
All other	5,987,700	1.6
Total	367,291,000	100.0

tributed. Of the total area of state forests nearly 85 per cent was located in the five northernmost provinces.

Annual Cut.—The total annual cut from all forests of European Russia was in the neighborhood of 7 billion cubic feet. This cut was classified by ownership as follows:

TABLE 139.—ANNUAL CUT CLASSIFIED BY OWNERSHIP

Forests	Cut per acre	Total cut [1]
	cu. ft.	*cu. ft.*
State	5.15	1,506,975,000
Crown	10.75	201,267,000
Communal	11.15	98,868,000
Peasant	18.59	910,405,000
Private	37.04	4,554,990,000
Total		7,272,505,000

[1] For Russia before the war, including Baltic provinces.

The annual cut in European Russia represented only 20 cubic feet per acre of the productive forest land.

Annual Growth.—A comparison of the annual growth and annual cut per acre shows that only a fraction of the annual growth is actually used. The reason is that the bulk of the tree growth is in regions but poorly developed and with no means of transportation. According to the statement of the Russian administration, only a small part of the annual growth can now be used on account of lack of market.

How far the actual utilization of the Russian state forests falls below their possible cut is well illustrated by the following figures of the amount of timber designated to be cut and the actual cut in the year 1913:

State forests.	Amount of timber designated to be cut	Amount of timber actually cut	Per cent
	cu. ft.	*cu. ft.*	
European Russia................	2,253,361,880	1,377,595,560	61.1

More wood is used from other forests than from those owned by the state, but these amount to only about one-third of the total forest area. In all forests not under control of the government the cutting is heavier than in those owned by the state.

Growth Exceeds Cut.—The annual cut in European Russia is about 7,000,000,000 cubic feet for the productive forest land, or 20 cubic feet per acre. On the other hand, the total annual growth for the same area is estimated at 12,711,000,000 cubic feet, or about 35 cubic feet per acre. In other words, the cutting in these forests is a little more than one-half of what is produced each year.

Assuming that one-half of the annual growth (12,711,000,000 cubic feet) is sawlog timber, there is produced annually 6,355,500,000 cubic feet of such material. With a home consumption of about 36 cubic feet of sawlogs per capita, the total would be 3,600,000,000 cubic feet, which, would still leave 2,755,500,000 cubic feet available for export. Before the war the wood deficit in all European countries amounted in logs to about 1,412,000,000 cubic feet per annum. Even though this deficit should become twice as large, European Russia could apparently furnish enough timber for the countries which depend on importations for their supply.

Domestic Consumption of Wood.—The total annual cut from all forests of European Russia is in the neighborhood of 7,000,000,000 cubic feet. If from this amount is deducted the annual export, amounting to 400,000,000 cubic feet (about 8,000,000 tons), the remainder, 6,600,000,000 cubic feet, is home consumption. This with a population of some 100,000,000 gives a per capita consumption of 66 cubic feet.

This is rather small, considering that Russia depends to a large extent upon wood as fuel not only for the heating of houses but also in industry and railroad transport. It is the chief fuel for the metallurgical industry of the Ural Mountains and other districts and is used exclusively for domestic purposes in the larger part of Russia, even in such large cities as Moscow and Petrograd, and by numerous wood-using industries. Before the war Russia used annually some 200 billion pounds of fuel of all kinds. Of this about half was consumed by industries and the other half for transport and heating. Of the different kinds of fuel, 47,520,000,000 pounds of coal from the Donetz basin went almost entirely for the use of industries; of oil there were about 19,440,000,000 pounds; of local coal 3,960,000,000 pounds; of peat 1,800,000,000 pounds; and of wood 108,000,000,000 pounds, or 3 billion cubic feet. Of the 3 billion cubic feet of wood, 600,000,000 was used by industries and the rest for domestic purposes.

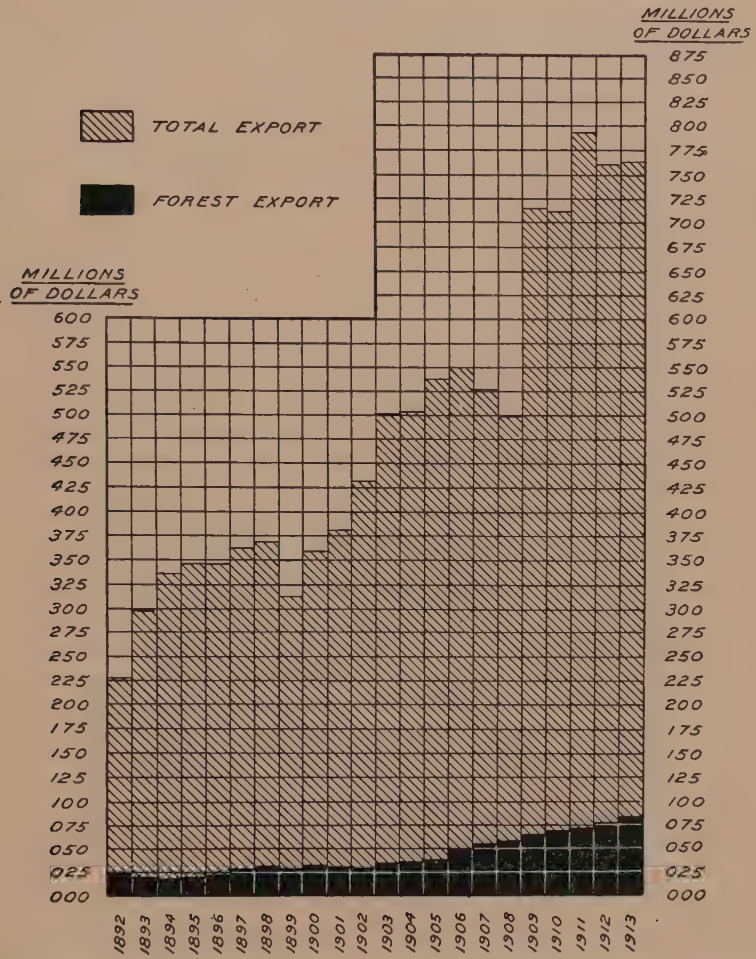


FIG. 9.—Growth of Russia's Entire Export and Export of Forest Products.

Of a total domestic consumption of 6,600,000,000 cubic feet, almost half was fuel wood. The dependence of the central and most densely populated portions of European Russia upon wood as fuel and as a source of power compelled transportation of large quantities of fuel wood from the more remote and heavily wooded provinces to the central part of Russia. Thus of the 3 billion cubic feet of fuel wood, used largely in the central provinces, only 600 million cubic feet was produced locally while the rest had to be brought by rail or water from distant regions.

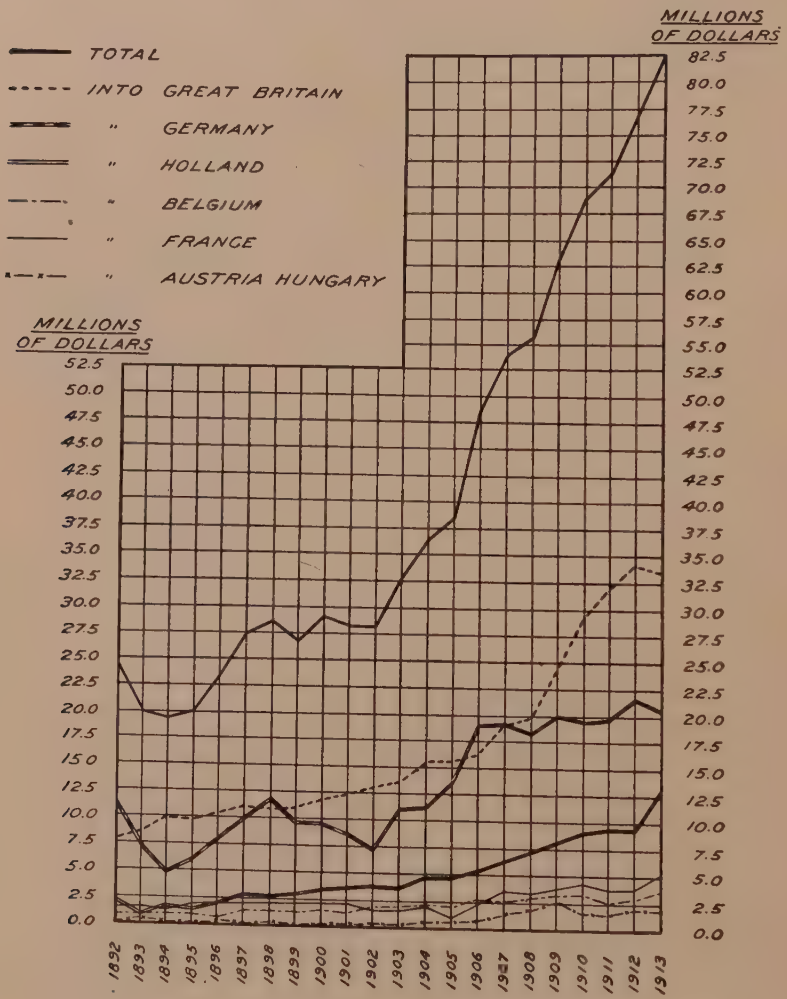


FIG. 10.—Russia's Export of Raw and Manufactured Forest Products.

Considering that in countries like Sweden and Norway, which are located within the same geographical latitudes as a large part of Russia, the per capita domestic consumption is 129 and 118 cubic feet respectively, 66 cubic feet per capita for Russia seems altogether too small. There is no question that, with the industrial development of Russia and better means of transportation, the capacity of the domestic market and the ratio of sawlog material to firewood will increase. It is of interest to note that while in Russia half of all the fuel obtained is used for domestic heating purposes, in England only 7 per cent is utilized for this purpose. In Russia the industries utilize about one-half of all the

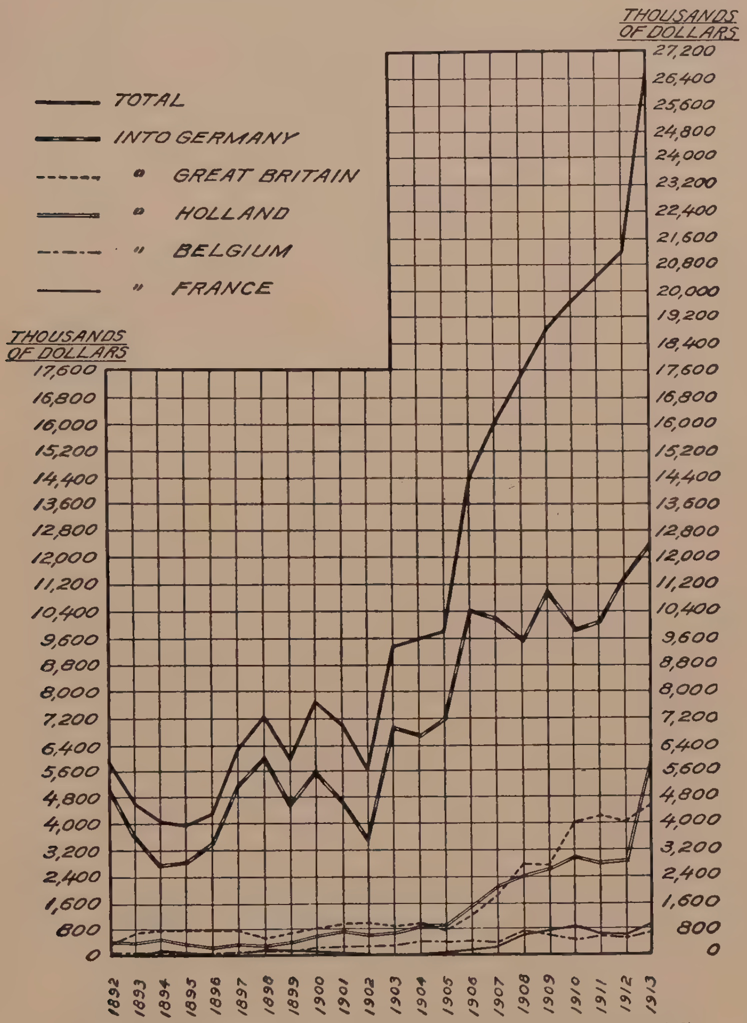


FIG. 11.—Russia's Export of Round Timber (Raw Material).

fuel obtained; in England about nine-tenths. Russia has large supplies of fuel of all kinds. With better distribution of coal and oil and development of water power, of which European Russia has about 7 million horsepower, the demand for wood as fuel is certain to decrease. Without the development of other sources of fuel the shortage of wood in the immediate vicinity of the large centers of population and industries is bound to become acute in spite of the tremendous supplies of timber.

Export Trade in Timber.—For a long time Russia has been engaged in timber export, which has grown at a much more rapid rate than

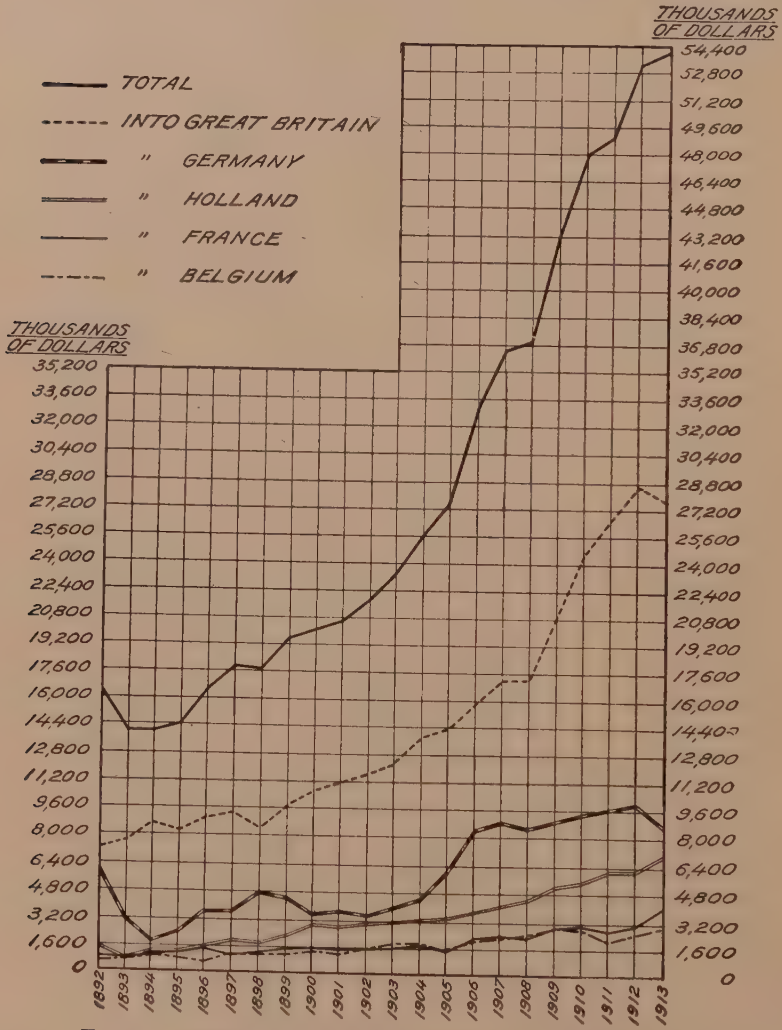


FIG. 12.—Russia's Export of Manufactured Forest Products.

the total export or the export of any one other product. Thus, during the period from 1800 to 1913, the value of the entire export increased 21 times, while the value of the timber export increased 126 times. The export of grain increased only 44 times in value. Before the war the timber trade stood next to the grain trade. Its growth was phenomenal between 1904 and 1914. The comparative growth of Russia's entire export trade and that of the export of forest products are brought out in Figs. 9 and 10.

The extent of Russia's forest export may be judged from the fact that the average annual export for the five-year period between 1903 and 1907 amounted to 5,241,636 tons, valued at $42,241,500. The average annual export for the period between 1908 and 1912 amounted to 7,404,138 tons, valued at $67,087,500. The kinds of forest products and the principal countries to which they were exported are shown in Tables 140 and 141 and Figs. 11 and 12.

TABLE 140.—KINDS OF FOREST PRODUCTS EXPORTED, 1913

Product	Amount	Per cent	Value	Per cent
	tons			
Logs—Oak	101,610	1.3	$ 1,467,000	1.9
Pine	614,970	7.7	3,514,500	4.5
Spruce	328,221	4.1	2,286,750	2.9
Other species	279,756	3.5	2,382,000	3.0
Poles	21,006	0.3	124,000	0.1
Beams	270,720	3.4	3,407,000	4.3
Boards and ties	3,742,200	46.9	45,938,500	58.5
Mine timber	792,306	9.9	5,033,000	6.4
Matchwood	11,736	0.1	219,000	0.3
Pulpwood	1,527,804	19.1	9,893,500	12.6
Cordwood of different species	123,894	1.6	484,000	0.6
Walnut and palmwood	5,589	0.1	294,250	0.4
Other woods not classified	42,354	0.5	1,477,500	1.9
Staves	117,648	1.5	2,021,000	2.6
Total	7,979,814	100.0	$78,542,000	100.00

More than half of the entire quantity of Russian timber exported consisted of raw or half-manufactured products. What this meant to the lumber industry may be judged from the fact that the average value of one ton of logs was $7.20, while the average value of one ton of manufactured products was $12.28. Even such general figures show how unprofitable the export of raw material or semi-manufactured products was from a national economic standpoint. The export of the entire timber product in manufactured form would increase its value by at least 35 or 40 per cent, and this additional value would remain in the country in the form of wages to the Russian worker.

Boards played the most important part in the Russian export trade,

Table 141.—Kinds of Forest Products and Countries to Which They were Exported, 1913

Product	Total export		To Germany			To Austria-Hungary			To Belgium		
	Tons[1]	Value	Tons	Per cent of total export	Value	Tons	Per cent of total export	Value	Tons	Per cent of total export	Value
Logs—Oak	101,610	$ 1,467,000	83,556	82.2	$1,247,000	10,476	10.3	$ 111,500	270	0.3	$ 3,500
Pine	614,970	3,514,500	594,234	96.6	3,374,500	8,010	1.3	25,000	540	0.1	5,500
Spruce	328,221	2,286,750	281,772	85.9	1,863,000	9	0.0	250	126	0.0	1,000
Other species	279,756	2,382,000	137,628	49.2	977,500	15,408	5.5	128,000	2,196	0.8	23,500
Poles	21,006	124,000	2,358	11.2	15,500	180	0.9	500	1,926	9.2	18,000
Beams	270,720	3,407,000	116,712	43.1	1,340,500	3,438	1.3	40,500	16,524	6.1	144,000
Boards and ties	3,742,200	45,938,500	621,756	16.6	6,531,000	48,060	1.3	730,500	224,352	6.0	2,812,500
Mine timber	792,306	5,033,000	38,592	4.9	290,000	234	0.0	2,000	58,716	7.4	443,500
Matchwood	11,736	219,000	1,404	12.0	24,500	....	......	....	1,080	9.2	20,000
Pulpwood	1,527,804	9,893,500	752,886	49.3	4,369,500	84,060	5.5	690,000	17,190	1.1	130,500
Cordwood of different species	123,894	484,000	46,530	37.6	186,500	3,474	2.8	10,500	3,114	2.5	18,500
Walnut and palm wood	5,589	294,250	360	6.5	22,000	9	0.1	250	....	......	....
Other woods not classified	42,354	1,477,500	6,876	16.2	225,500	918	2.2	10,000	1,350	3.2	57,000
Staves	117,648	2,021,000	36,882	31.4	650,000	11,754	10.0	175,000	3,654	3.1	73,500
Total	7,979,814	$78,542,000	2,721,366	34.1	$21,117,000	186,030	2.3	$1,924,000	331,038	4.2	$3,751,000

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[1] One ton equals 2,000 pounds.

Table 141.—Kinds of Forest Products and Countries to Which They were Exported, 1913—*Continued*

Product	To Great Britain			To Holland			To France		
	Tons	Per cent of total export	Value	Tons	Per cent of total export	Value	Tons	Per cent of total export	Value
Logs—Oak	2,592	2.6	$ 41,000	4,590	4.5	$ 62,500	126	0.1	$ 1,500
Pine	4,788	0.8	42,500	5,778	0.9	53,000	1,620	0.3	14,000
Spruce	2,502	0.8	23,500	42,066	12.8	376,000	1,746	0.5	23,000
Other species	8,046	2.9	67,000	115,938	41.4	1,179,500	540	0.2	6,500
Poles	8,118	38.6	33,000	7,344	35.0	47,500	1,080	5.1	9,500
Beams	59,760	22.1	1,183,500	72,846	26.9	668,500	1,440	0.5	30,000
Boards and ties	2,062,566	55.1	25,900,000	516,924	13.8	6,364,500	268,722	7.2	3,600,000
Mine timber	518,364	65.4	3,084,500	99,000	12.5	614,000	77,400	9.8	599,000
Matchwood	3,636	31.0	66,000	792	6.7	13,500	4,824	41.1	95,000
Pulpwood	161,910	10.6	972,500	480,960	31.5	3,475,000	30,798	2.0	256,000
Cordwood of different species	64,926	52.4	243,000	4,842	3.9	22,000	1,008	0.8	3,500
Walnut and palm wood	4,104	73.4	210,500	360	6.5	18,500	756	13.5	43,000
Other woods not classified	27,468	64.9	953,500	1,494	3.5	70,500	4,248	10.0	161,000
Staves	33,048	28.1	631,000	5,094	4.3	54,000	27,216	23.1	437,500
Total	2,961,828	37.1	$33,451,500	1,358,028	17.0	$13,019,000	421,524	5.3	$5,279,500

amounting to 47 per cent of the entire export in quantity and 59 per cent in value. Most of the boards (55 per cent) were shipped to Great Britain, the chief consumer of Russia's sawn timber. The shipment of boards to Holland, France, and Belgium was increasing, while Germany was also using a larger quantity of Russian boards, principally in the form of ties, which are classed with boards.

Logs had a very important part in the export trade, forming about 17 per cent of the entire timber export in quantity and 12 per cent in value, and going almost entirely to Germany. Of all the pine logs exported nearly 97 per cent were shipped to Germany; of spruce logs, 86; of oak logs, 82; and of logs of all other species, 50 per cent. Before the war there was a growing demand for Russian oak logs from Holland, Great Britain, and Austria-Hungary.

Mine props and timbers in general formed a very important item in Russia's export trade. Thus in 1913 the export of mine timbers amounted to 792,306 tons, valued at $5,033,000. The bulk of this material went to Great Britain (65 per cent), France, Holland, and Belgium.

Matchwood and pulpwood were exported in increasing quantities, chiefly into Germany, Austria-Hungary, Holland, Sweden, and later into Norway—that is, to countries engaged in the export trade of pulp, paper, and matches. Nearly 50 per cent of the pulpwood exported went to Germany. For the period between 1899 and 1913 the export of wood pulp increased in value from $217,000 to $10,000,000. The increase became particularly noticeable in 1905. The figures for wood pulp do not indicate the amount of pulpwood exported, since part was in the form of cordwood, particularly spruce cordwood.

The export of cordwood from Russia was very large. Thus, for 1913 the spruce cordwood export amounted to 43,632 tons, valued at $131,500. Pine cordwood was exported to the amount of 14,922 tons, valued at $64,500, and all other kinds to the amount of 65,340 tons, valued at $288,000, or a total of 123,894 tons, valued at $484,000. Spruce cordwood was shipped principally to Germany. Pine cordwood was distributed more or less uniformly among several countries. All other kinds were sent chiefly to Great Britain.

Staves were also an important item of Russia's export trade, having been exported in 1913 to the amount of 117,648 tons, valued at $2,021,000, chiefly to Great Britain, Germany, France, Austria-Hungary, Belgium, and Holland.

The Russian export trade was carried on through the Baltic, White Sea, Black Sea, and Azov ports, and the Russian-Prussian, Russian-Austrian, and Russian-Rumanian frontiers. The distribution of the exports through the different ports, as shown by the available figures for 1911, is given in Table 142.

TABLE 142.—DISTRIBUTION OF EXPORTS BY PORTS AND FRONTIERS

Ports and frontiers	Amount of exports	Per cent of total export
	tons	
Baltic ports	3,864,479	52.1
Russian-Prussian frontier	2,038,643	27.5
White Sea ports	1,183,715	16.0
Russian-Austrian frontier	199,918	2.6
Black Sea ports	123,568	1.7
Azov ports	316	0.1
Russian-Rumanian frontier	14	....
Total	7,410,653	100.0

It is clear that almost the entire export lumber trade before the war was carried on through the Baltic and White Sea ports and by land through the Russian-Prussian frontier.

A more detailed analysis of the export trade through the different ports is presented in Tables 143 and 144.

TABLE 143.—EXPORT TRADE THROUGH BALTIC PORTS

Port	Raw material	Per cent	Manufactured material	Per cent
	tons		*tons*	
Riga	298,116	17.6	1,396,620	82.4
Petrograd and Kronstadt	687,222	48.5	728,388	51.5
Windau	183,078	54.9	150,336	45.1
Libau	88,362	42.3	120,708	57.7
Other ports of Baltic Sea	149,580	70.6	62,064	29.4
Total	1,406,358	36.4	2,458,116	63.6

An interesting feature of the export trade through the Baltic ports is that, as a whole, the amount of manufactured products exceeded the amount of raw material. This is particularly true of the port of Riga.

The White Sea ports on the whole showed an excess of exports of manufactured products over raw material. Most of the product that came through the White Sea ports went to England in the form of sawed lumber.

Similarly, the ports of the Black Sea showed an excess of exports of manufactured products over raw materials. Most of the timber was shipped to the Near East and Mediterranean countries.

The Russian-Prussian was the most important channel through which the export trade from Russia to Germany took place. Nearly 60 per cent of the entire wood export to Germany went through this frontier, and 78.8 per cent of all the products thus exported was in the form of raw material, while only 21.2 per cent was manufactured or semi-manufactured. Nothing illustrates the economic policy of Germany toward the timber resources of Russia better than these figures. The amount of raw timber exported from Russia up to the beginning of the war increased. During the period between 1900 and 1913 the export of logs doubled,

Table 144.—Exports Through White and Black Sea Ports, Russian-Prussian and Russian-Austrian Frontiers

Port	Raw material	Per cent	Manufactured material	Per cent
White Sea Ports				
	tons		*tons*	
Archangel	251,424	28.6	589,878	71.4
Onega	46,908	42.3	63,792	57.7
Mezen	2,268	4.7	46,512	95.3
Western ports of the White Sea	5,058	2.7	177,876	97.3
Total	305,658	25.8	878,058	74.2
Black Sea Ports				
	tons		*tons*	
Odessa	8,082	6.8	110,322	93.2
Other ports of the Black Sea	2,592	50.2	2,574	94.8
Total	10,674	8.6	112,896	91.4
Russian-Prussian Frontier				
	tons		*tons*	
Russian-Prussian frontier	1,606,662	78.8	431,982	21.2
Russian-Austrian Frontier				
	tons		*tons*	
Russian-Austrian frontier	137,592	68.8	62,334	31.2

while the export of the manufactured product for the same period decreased both in quantity and value. The chief aim of Germany was to get from Russia as much as possible of the raw product for the development of its own lumber industry. In this Germany was favored by river transportation. She built her sawmills and wood pulp mills at the mouths of the rivers whose headwaters are in Russia and which are either drivable or navigable for their entire length. Because of this cheap water transport, Russian timbermen often found it more advantageous to float the timber to Germany than to ship it to mills and factories in Russia itself.

Nearly seven eighths of all the logs exported from Russia were sent to Germany. A large number of logs sent by Russia to Holland also found their way into Germany through the Rhine. Russian logs fed a large number of Germany's sawmills, and the price of these logs was controlled chiefly by the demand of the German lumber industry. The demand for logs in Russia itself affected the price but little, since the Russian sawmills utilized second-grade logs while the choice logs were shipped to the German mills. Among the species most largely exported to Germany, pine occupied first place, and next to it were such species as spruce and oak. About 50 per cent of all the wood exported for the manufacture of pulp, paper, and matches went to Germany, as well as 33 per cent of all the cordwood exported. The German economic policy toward Russian timber is well shown in the timber tariff adopted in 1904, just after the conclusion of the Russo-Japanese war. The rates of duty were as follows:

Product	Import duty per metric ton (1,000 kg.)
Pulpwood	Free
Round timber (logs)	$0.28
Oak staves	0.46
Hewn timber	0.55
Sawn timber	1.66

The character of export through the Russian-Austrian frontier was similar to the trade between Russia and Germany in that the amount of raw material (68.8 per cent) was much larger than the amount of manufactured products (31.2 per cent). Since Austria possessed extensive timber resources of its own and was a large timber exporter, the timber trade between the two countries was not important and the tariff agreement did not affect materially the development of the lumber industry in Russia.

The export trade was nourished chiefly by the forests of European Russia, particularly by those in the provinces close to the frontier, the Niemen and South Baltic regions, Russian Poland, and the region of the Rivers Dnieper and Dniester. These are the regions in which private forests predominated and which in the past have been severely over cut. As a result of the war, 16,000,000 acres in this territory is reported devastated; if this is true, the source of future export trade will naturally be transferred to the forests accessible from the White Sea. The ports of Archangel and Alexandrovsk are therefore destined to assume a greater commercial importance than before.

Timber Regions.—From the utilization standpoint the forests of Russia lend themselves to a division into timber regions tributary to seaports or railroad centers. Thus, the White Sea, with its ports, forms a natural outlet for the timber of the northern Russian provinces; the ports on the Baltic form an outlet for the forests located in the Baltic provinces. Similarly, the ports on the Black, Azov, and Caspian Seas provide a center toward which the shipments from adjoining forests naturally gravitate.

On this basis the forests of Russia are divided into ten timber regions:

1. Northern region (Archangel and Vologda).
2. North Baltic region (Olonets, Novgorod, and Petrograd).
3. South Baltic region (Pskov, Smolensk, and Vitebsk).
4. Niemen region (Grodno).
5. Region of the Rivers Dnieper and Dniester (Moghilev, Minsk, Volhynia, Kiev, Chernigov, Podolia, Poltava, Ekaterinoslav, Kherson, and Taurida).
6. Ural region (Perm, Ufa, and Orenburg).
7. Region of the Upper Volga (Tver, Yaroslav, Kostroma, and Vyatka).
8. Region of Central Volga (Vladimir, Nizhny-Novgorod, and Kazan).
9. Region of Lower Volga (Simbirsk, Samara, Saratov, Don, and Astrakhan).
10. The interior region (Moscow, Kaluga, Ryazan, Penza, Tambov, Orel, Tula, Kursk, Voronezh, and Kharkov).

The forest situation in each of these natural timber regions is discussed in detail below.

1. Northern Region (Archangel and Vologda).

Character of the Timber.—European coniferous forest. Scotch pine and spruce predominate. In the eastern portion larch, fir, and "cedar" (*Pinus cembra*) also occur, with birch, aspen, and alder in places.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 145.

TABLE 145.—FOREST AREA AND OWNERSHIP, NORTHERN REGION

Province	State	Private	Peasant	All other	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Archangel	86,368,800	800	210,600	67,100	86,647,300	44.6
Vologda	74,689,500	2,577,200	3,246,900	169,000	80,682,600	81.8
Total	161,058,300	2,578,000	3,457,500	236,100	167,329,900	57.2

The Lumber Industry.—The forests of the provinces of Archangel and Vologda are especially adapted to export trade. The region is traversed by the rivers Pechora, Northern Dvina, Mezen, Onega, Kola, and others, which empty into the Arctic Ocean or the White Sea, the ports of which have for a long time been in direct communication with western Europe. The sawmill industry began on the White Sea coast in the 19th century, but its development was slow until 1890. Since then it has been on the increase, especially in the district of the Western Dvina. Before the war there were over 55 sawmills in Archangel and Vologda provinces, with an annual turnover of about $15,450,000 and employing about 15,000 men. Archangel is the chief sawmill center and large port at the mouth of the Northern Dvina, along whose course are located some 54,000,000 acres of forests. In the port of Archangel alone there were 25 sawmills, which produced about 70 per cent of the entire value of timber exported to the ports of the White Sea and the Arctic Ocean.

TABLE 146.—DEVELOPMENT OF SAWMILL INDUSTRY

District	Number of sawmills	Number of frame swinging machines	Number of beams sawed per year	Number which might be sawed per year
			pieces	*pieces*
Archangel	25	118	6,075,000	7,790,000
Onega	4	23	1,000,000	1,100,000
Kovda	3	14	700,000	800,000
Soroka	2	17	650,000	950,000
Umba	1	3	150,000	150,000
Kem	1	7	300,000	300,000
Mezen	2	10	350,000	400,000
Keret	1	3	100,000	150,000

Table 146 shows the development of the sawmill industry in the province of Archangel before the war.

It would seem, therefore, that up to 1914 the sawmills did not work to their fullest capacity, and that their efficiency could still be increased at least 25 per cent. The further development of the lumber industry in this region depends on more adequate equipment for handling the timber cargoes.

Future of the Export Trade in the Region.—There can be no doubt that the timber business in northern Russia will be considerably augmented when the virgin forests of Archangel and Vologda become better known and more thoroughly exploited. Everything indicates that this extension will be particularly remarkable in the vast virgin forests which abound in the basins of the rivers tributary to the White Sea and the Arctic Ocean.

Only the pine and spruce forests have ever been logged. The utilization of birch and aspen is still a matter of the future. The birch forests may yield considerable quantities of wood for use in dry distillation. Furthermore, this timber is suitable for different articles, such as gun-

TABLE 147.—POSSIBLE AND ACTUAL SALES OF TIMBER

Quantity Offered for Sale

Province	1911	1912	1913
	cu. ft	*cu. ft*	*cu. ft.*
Archangel	510,320,000	585,416,000	607,299,000
Vologda	255,863,000	251,062,000	263,189,000
Total	766,183,000	836,478,000	870,488.000
Quantity Actually Sold			
	cu. ft.	*cu. ft.*	*cu. ft.*
Archangel	186,132,000	195,755,000	241,891,000
Vologda	88,014,000	103,795,000	106,235,000
Total	274,146,000	299,550,000	348,126,000
Per Cent of Quantity Unsold			
	per cent	*per cent*	*per cent*
Archangel	64	66	60
Vologda	65	59	59

stocks and handles for various tools, and is an excellent fuel. Aspen will undoubtedly find extensive use in the match industry and in the production of pulp. Pine predominates in the western part of Archangel and Vologda. The cut in these two provinces has hitherto been far less than they are capable of yielding. This is very well shown by the amounts of timber offered for sale and those actually sold (Table 147).

Only one-third of the timber offered for sale was actually sold. The amount put up for sale was far below the possible cut as based on the annual growth. The annual cut possible from the forests of these two provinces has been placed at 2,681,459,000 cubic feet, of which 1,072,584,000, or 40 per cent, is firewood, and the remaining 60 per cent is timber. Half of the timber, or 804,438,000 cubic feet, is large sawlog timber and the other half is smaller structural timber.

2. North Baltic Region (Olonets, Novgorod and Petrograd).

Character of Forest.—Scotch pine and spruce predominate. In the governments of Petrograd and Olonets pine and spruce are about equal in amount, and there are birch and aspen in mixture. Olonets has less birch and aspen and more pine than Petrograd.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 148.

TABLE 148.—FOREST AREA AND OWNERSHIP, NORTH BALTIC REGION

Province	State	Private	Peasant	All other	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Olonets	12,082,400	1,062,200	2,187,300	145,400	15,477,300	47.6
Novgorod	4,041,800	8,258,500	1,723,700	645,000	14,669,000	53.9
Petrograd	956,500	4,003,700	130,100	41,200	5,131,500	50.2
Total	17,080,700	13,324,400	4,041,100	831,600	35,277,800	50.4

The Lumber Industry.—Prior to the war, the lumber industry was very important in the region. At some places almost the entire population was engaged in it. The industry was centered principally in Petrograd and Novgorod. The sawmills were smaller than those in the northern region. They worked to meet both the needs of the city of Petrograd and the increasing demand from abroad for manufactured lumber. Besides sawmills and veneer plants, the principal wood-using industries were box making, manufacture of excelsior, and cutting of ties, mine props, and cordwood. There were not less than 22,000 wood-workers. Woodenware, furniture, agricultural implements, and wagons were also among the articles produced. With the construction of the railroad from Petrograd to Vologda, the lumber industry received a new impetus. There were some importations to Petrograd from the Vistula region and Finland. What hampered the development of the lumber industry in this region was the poor condition of the drivable streams and roads, and lack of credit to the small operator.

3. South Baltic Region (Pskov, Smolensk, and Vitebsk).

Character of Forest.—Scotch pine and spruce predominate in Pskov, spruce in Smolensk, and pine in Vitebsk.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 149.

TABLE 149.—FOREST AREA AND OWNERSHIP, SOUTH BALTIC REGION

Province	State	Private	Peasant	All other	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Vitebsk	473,600	2,178,300	21,900	7,200	2,681,000	25.9
Smolensk	231,500	2,506,800	401,900	54,500	3,194,700	24.5
Pskov	182,600	2,586,600	67,000	61,500	2,897,700	29.0
Total	887,700	7,271,700	490,800	123,200	8,773,400	26.0

The Lumber Industry.—Smolensk had 71 sawmills employing over 2,000 men; other wood-using industries of the factory type are only poorly developed. On the other hand the home industry in timber was well advanced; wagons and cooperage were the most important products. In this region private forests predominated; they have been largely devastated, the timber is expensive, and the means of communication are very poor. During droughts the navigation and floating of rafts on the western Dvina and its tributaries as well as on the rivers of the Dnieper basin become difficult on account of sand bars.

4. Niemen Region (Grodno).

Character of Forest.—Conifers predominate. There is more pine than spruce. The conifers have an admixture of aspen, birch, and oak.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 150.

The Lumber Industry.—The industry before the war was important in many places. A great deal of raw and some manufactured material was shipped abroad; the poorer grades remained at home for local needs. Especially developed was log driving and floating of pulpwood on the rivers Niemen and Viliya to the wood-using establishments and pulp

TABLE 150.—FOREST AREA AND OWNERSHIP, NIEMEN REGION

Province	State	Private	Peasant	All other	Total	Per cent of total land area
	acres	*acres*	*acres*	*arces*	*acres*	
Grodno	1,069,800	990,900	18,000	19,200	2,097,900	23.6

mills in Germany. A great many ties were made in the region. The local sawmills worked only for local markets. On the whole the sawmill industry was not well developed, nor were the large wood-using establishments, of which there were very few. There were more men engaged in the home industry than in factories.

5. Region of the Rivers Dnieper and Dniester (Moghilev, Minsk, Volhynia, Kiev, Chernigov, Podolia, Poltava, Ekaterinoslav, Kherson, and Taurida).

Character of Forest.—In the northern part spruce predominates, forming 50 per cent of all the forest, with little pine. There are still large quantities of oak, the export of which is growing.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 151.

TABLE 151.—FOREST AREA AND OWNERSHIP, REGION OF THE RIVERS DNIEPER AND DNIESTER

Province	State	Private	Peasant	All others	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Moghilev	292,400	2,317,700	570,000	21,100	3,201,200	28.3
Minsk	1,280,000	7,110,800	67,500	15,400	8,473,700	40.7
Kiev	516,000	1,419,000	6,800	52,500	1,994,300	16.3
Chernigov	272,500	1,249,800	271,600	32,700	1,826,600	15.3
Podolia	253,200	775,900	....	13,700	1,042,800	10.4
Volhynia	1,103,100	3,573,400	3,900	23,700	4,704,100	28.3
Poltava	35,100	434,500	92,900	13,300	575,800	5.0
Ekaterinoslav	36,400	369,100	172,400	10,300	588,200	3.8
Kherson	111,100	148,500	23,200	9,200	292,000	1.6
Taurida	173,400	343,000	266,800	342,500	1,125,700	7.7
Total	4,073,200	17,741,700	1,475,100	534,400	23,824,400	16.1

The Lumber Industry.—Until the beginning of the war this region was one of the most important centers of the lumber industry and the timber trade. The material was used both for home consumption and for distant markets. Some round timber was sent abroad, but the bulk was sawed up into boards, box material, excelsior, and matchwood. The manufacture of veneer was especially developed. There was also a great deal of wood distillation, the largest distillation plant having been located in this region. Not less than 30,500 peasants were engaged at home in the manufacture of wooden products—tubs, woven and splint baskets, agricultural implements, and wagons. There were about 11,000 cabinet makers among these home workers.

6. Ural Region (Perm, Ufa, and Orenburg).

Character of the Forest.—The forests are principally of pine and spruce. In places there is also fir in mixture with spruce and "cedar" (*Pinus cembra*). Oak is abundant in Ufa and Orenburg.

Area and Ownership.—The extent of the forest in this region and the character of ownership are shown in Table 152.

Table 152.—Forest Area and Ownership, Ural Region

Province	State	Private	Peasant	All others	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Perm	26,266,800	13,258,600	3,605,600	2,971,100	46,102,100	57.3
Ufa	2,532,600	3,691,800	987,300	43,100	7,254,800	25.0
Orenburg	637,100	1,937,800	4,255,100	8,700	6,838,700	15.1
Total	29,436,500	18,888,200	8,848,000	3,022,900	60,195,600	38.9

The Lumber Industry.—Although the lumber industry was not the largest in the region, it was of considerable importance because of the metallurgical industry which depends on the timber resources. There were a number of sawmills which produced boards; staves, boxes, excelsior, and parquetry were the other products of the region. The manufacture of trunks and of wood pulp was also developed to a considerable extent. The wood distillation industry was very extensive, charcoal, wood alcohol, and tar being the main products. The peasant workers, of whom there were many, were engaged in wagon making and cabinet work. The products of this region were partly consumed locally and partly sent by water to cities along the Volga and Kama rivers. Some of the product was even sent to the Siberian markets. Just before the war some material had been sent to Archangel and Petrograd for export abroad. The forests most exploited were those belonging to private owners and to the mining department. The government forests proper could be developed to a large extent if there were good roads.

7. Region of the Upper Volga (Tver, Yaroslav, Kostroma, and Vyatka.)

Character of Forests.—Pine and spruce are abundant. Mixed with them are birch, aspen, and alder; also oak in the southern part.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 153.

TABLE 153.—FOREST AREA AND OWNERSHIP, UPPER VOLGA REGION

Province	State	Private	Peasant	All others	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Tver	1,018,300	2,348,000	202,000	88,400	3,656,700	24.1
Yaroslav	539,100	1,819,100	119,000	65,800	2,543,000	30.7
Kostroma	4,726,700	4,181,000	420,600	91,400	9,419,700	46.6
Vyatka	10,425,300	1,861,600	3,194,200	20,200	15,501,300	41.1
Total	16,709,400	10,209,700	3,935,800	265,800	31,120,700	38.2

The Lumber Industry.—The lumber industry is not developed uniformly throughout the region. In some places it is the main occupation of the entire population. Sawmills are being developed rapidly, machine labor is crowding out manual labor, and within the last few years before the war there was a considerable increase in the number of factories, both large and small. In the province of Kostroma there were several wood-using plants employing over 100 men each, but the wood-using industries of the peasant workers were more highly developed. The chief products are woodenware, cups, spoons, footwear made of bast, and bast ropes. The reason for the variety of the industries is the variety of the available timber. Much of the timber is also used for ship-building and furniture. The wood-using industries would be capable of great development if there were good roads and more railroads, and if the drivable and navigable rivers were in better condition.

8. Region of Central Volga (Vladimir, Nizhny-Novgorod, and Kazan).

Character of the Forests.—Oak predominates, particularly in Nizhny-Novgorod and Kazan.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 154.

The Lumber Industry.—Although the timber resources are much smaller in this region than farther north, the industries dependent upon wood are essential as subsidiary occupations to the population. In several places the wood-using industry is the main source of revenue. The cutting of cordwood and poles and driving them to points of consumption

TABLE 154.—FOREST AREA AND OWNERSHIP, CENTRAL VOLGA REGION

Province	State	Private	Peasant	All others	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Vladimir	858,300	1,823,100	382,500	98,500	3,162,400	27.8
Nizhny-Novgorod	1,867,700	2,283,900	483,000	62,400	4,697,000	38.2
Kazan	3,615,800	659,300	333,400	38,200	4,646,700	30.2
Total	6,341,800	4,766,300	1,198,900	199,100	12,506,100	32.0

within Russia engage a large portion of the population. The burning of wood in pits to obtain products of distillation is very common.

9. Region of Lower Volga (Simbirsk, Samara, Saratov, Don, and Astrakhan).

Character of the Forests.—Broadleaf forests predominate. In the northern portion of the region there are some pine and spruce. Oak is the most important species. It predominates in Simbirsk and makes up 14 per cent of the forest in Samara and Saratov. Among other broadleaf species are elm, maple, ash, and birch. In Astrakhan there are shrubs, but no forests.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 155.

TABLE 155.—FOREST AREA AND OWNERSHIP, LOWER VOLGA REGION

Province	State	Private	Peasant	All others	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Simbirsk	2,175,400	1,091,300	55,100	20,800	3,342,600	28.7
Samara	1,469,900	724,600	584,100	44,000	2,822,600	7.6
Saratov	506,200	1,042,000	779,700	76,300	2,404,200	12.7
Astrakhan	331,000	35,300	139,900	4,400	510,600	3.4
Don	2,800	230,800	520,200	89,000	842,800	2.1
Total	4,485,300	3,124,000	2,079,000	234,500	9,922,800	8.1

The Lumber Industry.—This region is chiefly a consumer of wood. Timber is scarce and consists entirely of hardwoods. The sawmills and the wood-using industries are fed mostly by the timber that is floated along the River Volga from the north. The trade in lumber is very large, reaching from 13 to 15 million dollars a year. Much of the product is exported to the ports of the Azov Sea, and from there sent to northern Caucasus and Siberia. Here, as in every other region of Russia, the industry is capable of tremendous expansion if the means of transportation can be improved.

10. The Interior Region (Moscow, Kaluga, Ryazan, Penza, Tambov, Orel, Tula, Kursk, Voronezh, and Kharkov).

Character of the Forest.—Pine predominates only in Ryazan and Orel. In Moscow and Kaluga half of the forests are pine and the other half broadleaf, while in the provinces of Tambov, Penza, Tula, Voronezh, Kursk, and Kharkov, broadleaf forests predominate. Oak is the principal species. It occupies 68 per cent of the area in Kursk, 53 per cent in Voronezh, 45 per cent in Tula, 36 per cent in Penza, 15 per cent in Kaluga, 13 per cent in Orel, 11 per cent in Tambov, and only 5 per cent in Ryazan.

Area and Ownership.—The extent of the forest within this region and the character of ownership are shown in Table 156.

TABLE 156.—FOREST AREA AND OWNERSHIP, INTERIOR REGION

Province	State	Private	Peasant	All others	Total	Per cent of total land area
	acres	*acres*	*acres*	*acres*	*acres*	
Moscow	1,338,500	383,500	383,500	101,200	2,210,200	27.7
Kaluga	1,586,300	220,300	220,300	71,400	2,100,200	28.0
Ryazan	1,177,700	503,600	503,600	17,600	2,033,600	20.1
Penza	747,900	268,300	268,300	29,400	1,674,600	18.1
Tambov	966,500	305,700	305,700	190,400	2,595,700	16.2
Orel	1,195,300	107,400	107,400	59,000	2,092,500	18.7
Tula	446,500	55,300	55,300	9,600	614,600	8.3
Kursk	282,900	190,300	190,300	18,000	617,700	5.5
Voronezh	304,400	558,400	558,400	18,100	1,179,200	7.4
Kharkov	559,800	381,800	381,900	6,200	1,124,100	8.6
Total	4,140,000	8,606,800	2,974,700	520,900	16,242,400	14.8

The Lumber Industry.—The region is not very rich in timber. Most of the product is used locally. A great deal of lumber is imported from other regions, principally from the Volga region. The greatest consumer of forest products, especially of cordwood, is Moscow. The home wood-using industry is the characteristic industry of the region; nearly 104,000 peasant workers are employed in it. The chief products are wagons, cooperage, and furniture.

The Lumber and Wood-Using Industries in General.—*Number of Plants and Workmen Employed.*—The lumber industry of Russia developed rapidly within the last two decades prior to the war. The latest figures available are for 1911, when the number of sawmills and other wood-using plants operated by power was 2,166, employing

111,703 workmen. The growth of the industry may be judged from the fact that for the period between 1900 and 1911 the number of sawmills and veneer factories increased 82 per cent and the number of workmen in them 87 per cent. The average number of workmen employed in a sawmill was about 45, although there were sawmills which employed from 500 to 1,000 men.

Cottage Wood-Using Industries.—Besides the workmen employed in the sawmills and wood-using plants, and subject to inspection by factory inspectors, many small industries are carried on in the homes or cottages of the peasants. According to the best estimates available, there were not less than 377,000 people engaged in "home" wood-using industries. Among the different occupations these workmen were distributed somewhat as follows:

Occupation	In the cottage industry	In factories
Manufactures of bast and birch bark	114,834	....
Production of cooperage	66,258	4,135
Basket making	35,888	....
Wagon making	72,023	....
Cabinet work	50,580	18,344
Wood carving	10,000	1,758

Thus, only in the case of cabinet work, which includes the manufacture of doors, window frames, and furniture, does factory production show any considerable number of men employed. Most of the other wood-using industries, particularly the making of woodenware and manufactures from bast and birch bark, are in the hands of the peasants working at home. This is largely due to the lower prices for raw material which are found in the vicinity of the villages and to the cheap water transportation. In spite of the rapid industrial development of Russia, these small home wood-using industries will, for a long time, remain a feature of Russia's lumber industry and compete with the large wood-using plants.

Sawmills.—The sawmills which work chiefly for export trade are, as a rule, steam operated, well built, and provided with up-to-date machinery. This is mostly of the sash or gang saw type, with one or several frames. The sawmills are provided with various circular saws for edging, cleaving, and cutting. The machinery is largely supplied by Bolinders, Stockholm, or Jansen and Dahl, Christiana. There is electric light at almost all of the mills, as well as workshops for repairs.

Many of the mills, particularly in the northern region, are owned by Swedes. Side by side, however, with the up-to-date sawmills throughout Russia are primitive sawmills; even whipsawing is common. Not less than 100,00 horsepower is employed in the sawmill and wood-using industries. While Russia's woodsmen are skilful and experienced workers, there is no large class of sawmill workmen in Russia. This is a point that should be considered in any organization of the Russian lumber industry.

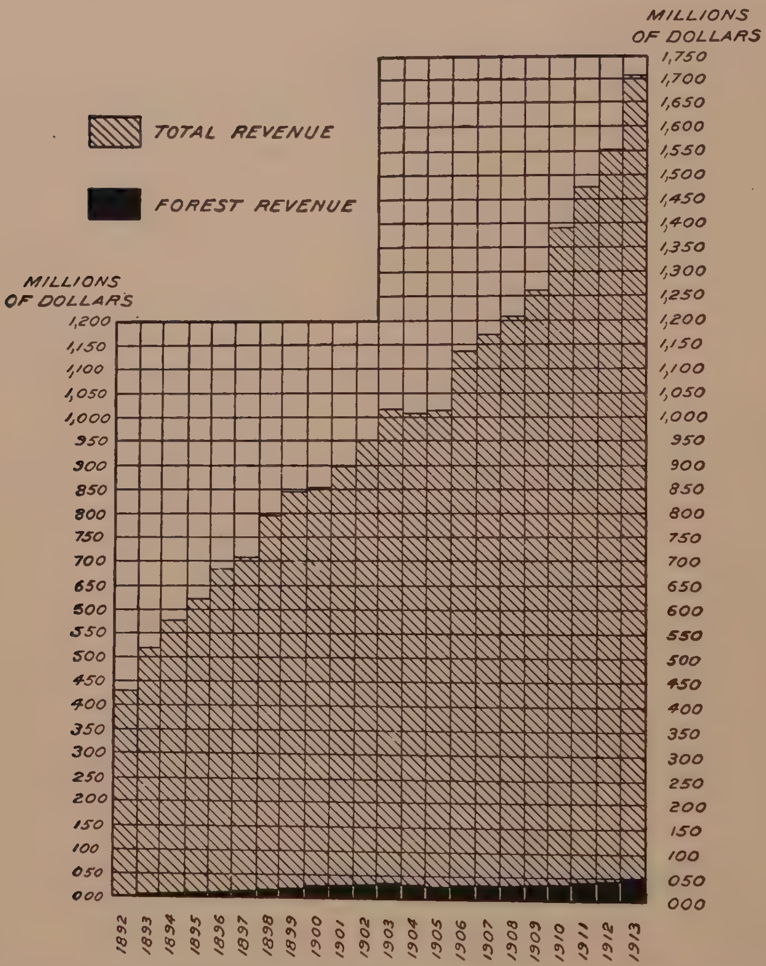

FIG. 13.—Russia's Revenue from all Sources and that from State Forests.

Revenue.—The total revenue from state forests before the war (1913) amounted to about 48 million dollars, or 10 cents per acre. Of this the cost of protection, administration, management, and forest education was about 16 million dollars, or about 33 per cent of the gross revenue. The net revenue amounted to about 32 million dollars, or about 7 cents per acre. The average revenue, however, varied greatly from province to province. Thus, while in some of the Siberian provinces it was less than half a cent, in some of the central European provinces it was as much as one dollar per acre, and in some even two dollars. (Fig. 13.)

Forest Laws.—Before the revolution Russia had very effective laws with regard to privately owned forests. Private forests were divided into two classes—protective and commercial. Under protective forests were included forests at headwaters of streams essential for the regulation of flow; forests on shifting sands whose destruction would cause the sand to shift and endanger cities, villages, agricultural lands, or other property; forests near the seashore, and along the shores of rivers, canals, and artificial reservoirs. The cutting in protective forests could be done only in accordance with a plan approved by the forest department. Clear cutting as a rule was not allowed; selection cutting with natural reproduction was the general rule. After certain forests were declared protective forests all cutting in them had to be stopped until the department prepared a plan of management which the owner had to follow. In all other forests the owner had much more freedom of action. In every case, however, permits were necessary for clearing the forest and converting it to some other use. Reasons considered sufficient for clearing the forest were proof by the owner that there was a much larger profit for him under other use of the land, or when it was needed for vineyards, orchards, or other agricultural use. Excessive clear cuttings, which would result in depletion of the forest, prevention of natural regeneration, or in the cutover areas becoming waste land, were prohibited. The drawbacks of this law were that it was not always fully enforced and that the private owner had to stand the loss in revenue involved in the restricted use of forests declared protective.

Forest Education.—Before 1917, Russia had two forest schools for the training of higher forest officers and 30 schools for the training of the lower forest personnel. The number of forest schools has increased considerably since the revolution; there are, however, no definite figures as to their number or location.

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THE CAUCASUS REGION

The Caucasus region is divided into Cis-Caucasia and Trans-Caucasia. Cis-Caucasia is in Europe and Trans-Caucasia is in Asia. The region is treated here as a whole. The entire territory of Caucasia is 116,000,000 acres. Of this, agricultural land (under vineyards, orchards, cotton, cereals, etc.) occupies about 40 per cent, forest about 16 per cent, grazing areas—winter and summer (in the mountains)—about 14 per cent, and unproductive land (glaciers, rocks, arid prairies, inaccessible places, etc.) about 30 per cent. The total forest area is placed at 18,469,000 acres, or 15.9 per cent of the entire land area. This makes 1.4 acres per capita. By provinces and districts it is distributed as is shown in Table 157.

TABLE 157.—DISTRIBUTION OF FOREST AREA IN THE CAUCASUS

Provinces and Districts	Total land area	Forest area	Per cent forested
	acres	*acres*	
Cis-Caucasia:			
Kuban	23,455,000	2,705,000	11.5
Stavropol	13,423,000	77,700	0.6
Terek	18,020,000	2,690,800	14.9
Trans-Caucasia:			
Black Sea	2,061,000	1,391,500	67.5
Baku	9,641,000	873,900	9.1
Daghestan	7,342,000	426,600	5.8
Yelisavetpol	10,876,000	1,246,500	11.5
Tiflis	10,099,000	3,409,200	33.8
Zakatalsky District	985,000	473,900	48.2
Kutais	5,213,000	2,318,700	44.5
Batum	1,724,000	1,050,000	60.9
Sukhum District	1,629,000	1,260,200	77.4
Erivan	6,865,000	234,400	3.4
Kars	4,634,000	310,600	9.7
Total	115,967,000	18,469,000	15.9
Europe	54,898,000	5,473,500	10.0
Asia	61,069,000	12,995,500	21.3

The area of the forest in Caucasia thus varies greatly. Within the prairie region of Stavropol Province there is practically no forest (0.6 per cent). In Erivan there is little (3.4 per cent). In other localities there is a great abundance as, for instance, in Batum province 60.9 per cent, Black Sea 67.5 per cent, and Sukhum district 77.4 per cent.

Character of Forest.—Hardwoods predominate, forming 78 per cent, while conifers constitute only 22 per cent of the entire forest area. The species in the order of their importance are as follows:

Beech (*Fagus sylvatica*). This is the most widely distributed species, and occupies 25.1 per cent of the total forest area, or 4,635,600 acres. It occurs in the middle mountainous forest belt between 3,300 and 6,600 feet above sea level, and reaches enormous dimensions—140 feet in height and 7 feet in diameter. It attains an age of 300 years, but the old trees are liable to be infected with rot. The stand per acre at the age of 120 years averages 5,700 cubic feet.

Oak (*Quercus*) occupies 17.0 per cent of the entire forest area, that is, 3,084,200 acres. Three different species are recognized:

1. Summer oak (*Q. sessiliflora*) is the most widely distributed species in Caucasia, occurring from sea level to 5,900 feet above the sea.

2. Pedunculate oak (*Q. pedunculata*) occurs in northern Caucasia and Trans-Caucasia. It is never found higher than 4,900–5,600 feet above sea level.

3. Chestnut oak (*Q. castaneafolia*) occurs only along the coast of the Caspian Sea up to an elevation of 5,900 feet, and reaches a height of 98 feet, and diameters of 5 to 7 feet, at ages of 400 to 500 years. The average stand per acre at the age of 120 years is from 3,250 to 4,075 cubic feet. The stands of very old oak suitable for tight cooperage are partly exhausted.

Hornbeam (*Carpinus*) occupies about 12.8 per cent of the entire forest area, i.e., 2,364,100 acres. Two species are recognized—common hornbeam (*Carpinus betulus*) and *C. duinensis*. The average stand per acre is from 1,630 to 3,250 cubic feet, the height not over 70–77 feet, and the diameter from 8 to 13 inches.

Pine occupies 8.1 per cent of the total forest area, or about 1,495,800 acres. Six different species occur in Caucasia:

1. Common pine (*Pinus sylvestris*). This has the widest distribution. It occurs in a mountain belt between 2,600 and 7,900 feet above sea level. As a rule it is confined to the upper altitudinal belt, often forming the timber line. The height is not over 100 to 120 feet, and the diameter 3½ feet.

2. Mountain pine (*Pinus montana*) is confined to the high altitudes. The wood is used chiefly for turning.

3. Black pine (*Pinus laricio*) is found only on the coast of the Black

Sea. It is an enormous tree, reaching 120 feet in height and 3½ to 4⅔ feet in diameter.

4. Maritime pine (*Pinus maritima*) occurs only in Trans-Caucasia along the entire northeastern shore of the Black Sea. It does not extend higher than 1,000 feet above sea level.

5. Italian pine (*Pinus pinea*) occurs sporadically in western Trans-Caucasia. The seeds have a sweetish, agreeable taste and are used for food.

6. Eldarian pine (*Pinus eldarica*) occurs only in the Tiflis district, in a limited amount, and is of no economic importance.

Eastern spruce (*Picea orientalis*) occupies about 6.6 per cent of the entire forest area, that is, about 1,219,100 acres. In northern Caucasia it occurs sporadically in small quantities. In Trans-Caucasia it occurs in vast forests in Batum and Kutais Provinces and the Sukhum district. Its vertical distribution is from 4,250 to 6,600 feet above sea level. The trees reach from 70 to 175 feet in height and 5 feet in diameter. The average stand per acre at the age of 150 years is 5,700 to 6,500 feet. The virgin spruce forests are very dense, and some of the old forests often have as much as 12,200 cubic feet of wood per acre. It is the species preferred above other conifers in Caucasia.

Caucasian fir (*Abies nordmanniana*) occupies about 6 per cent of the entire forest area, that is, about 1,108,100 acres, and occurs chiefly in the western part of Caucasia, where it often forms vast forests, as, for instance, in the Black Sea Province and the Kuban district. It occurs ordinarily, however, with spruce and beech as a subordinate species and is found chiefly in the upper altitudinal belt from 4,250 to 6,600 feet above sea level, occasionally descending as low as 2,950 feet. It reaches 150 feet in height and about 5.8 feet in diameter. Stands of very old trees occasionally run as high as 14,250 cubic feet per acre. These forests are in the true sense primeval, untouched by the ax. The fir forests furnish the largest timber, yet fir lumber is valued less than spruce and pine because the boards warp and split quickly.

Juniper occupies about 1.1 per cent of the entire forest area, that is, about 203,100 acres. There are six distinct species of juniper: *Juniperus excelsa, Juniperus foetidissima, Juniperus oxycedrus, Juniperus communis, Juniperus nana, Juniperus sabina.* The wood of *Juniperus excelsa* and *J. oxycedrus* is used for making pencils.

Of other conifers may be mentioned *yew* (*Taxus baccata*), which occurs throughout the entire Caucasian region, chiefly in the lower and middle altitudinal zone from sea level to between 4,900 and 5,600 feet.

Birch occupies 3.8 per cent of the entire forest area, or about 701,700 acres. The following species are recognized: (a) common birch (*Betula alba*), occurring everywhere in Caucasia at altitudes from 4,900 to 6,600 feet—a small tree reaching only 82 feet in height, and used chiefly for firewood; (b) downy birch (*Betula pubescens*), having the same distribution as common birch.

Elm occupies about 3.2 per cent of the total forest area, or about 591,000 acres. Three species of elm are recognized: (a) *Ulmus campestris* occurs everywhere in a belt up to 650 feet above sea level and grows to 70 feet in height and 4⅔ to 7 feet in diameter. It is used in wagon making and for furniture. The elm burls used in turning are particularly valuable. (b) Mountain elm (*Ulmus montana*), which occurs in Trans-Caucasia, is exclusively a mountain tree. It does not differ from the common elm. (c) *Ulmus effusa* occurs rarely. It has wood similar to that of the other two elms.

Zelkva (*Zelkowa crenata*), a genus very closely related to the genus *Ulmus*, occurs only in restricted localities in Baku and Kutais Provinces. It is a disappearing species, and therefore has no economic value.

Alder occupies about 2.8 per cent of the total forest area, or about 522,200 acres. Four distinct species of alder are recognized: black alder (*Alnus glutinosa*), white alder (*A. incana*), heart-shaped alder (*A. cordifolia*), and eastern alder (*A. orientalis*).

Maple occupies about 2.8 per cent of the entire forest area, or about 517,100 acres. The following species occur: common maple (*Acer campestre*), handsome maple (*A. laetum*), *A. platanoides*, and high mountain Caucasian maple (*A. trautvetteri*). In addition there are *A. tataricum*, *A. peudoplatanus*, *A. opulifolium*, and *A. hyrycanum*.

Ash occupies about 2.6 per cent of the total forest area, or about 480,300 acres. The following species occur: (1) Common ash (*Fraxinus excelsior*) occurs everywhere, although as a subordinate tree. The altitudinal distribution is from sea level to 5,900 feet. Under favorable conditions it attains 105 feet in height and 20 inches in diameter. (2) *Fraxinus oxyphylla* occurs in Trans-Caucasia. It does not differ materially from common ash.

Basswood occupies about 2.5 per cent of the total forest area, that is, about 461,700 acres. The following species occur: (1) Large-leaved basswood (*Tilia platyphylla*) occurs occasionally in northern Caucasia and in Trans-Caucasia in the lower and middle altitudinal zones (1,650 to 4,900 feet above sea level). (2) Small-leaved basswood (*Tilia parvifolia*) occurs only occasionally in the upper altitudinal forest belt 4,900 to 6,600 feet above sea level. (3) Intermediate basswood (*Tilia intermedia*), occurs more widely than other basswoods, from sea level to 5,600 feet elevation. Basswood is one of the most useful species. It reaches an age of 800 years and attains at 100 years a height of 100 feet and a diameter of 16 inches.

Poplar occupies 2.3 per cent of the total forest area, or about 424,700 acres. Three species of poplar are found: (1) Aspen (*Populus tremula*), a very common tree in Cis-Caucasia, has a vertical distribution from sea level to between 5,900 and 6,600 feet. (2) Black poplar (*Populus nigra*) occurs almost everywhere in northern Caucasia and Trans-Caucasia from sea level to 4,900 feet. (3) *Populus euphratica* is recorded only in the southern part of Erivan Province.

Willow occupies about 1.2 per cent of the total forest area, or about 221,400 acres. A large number of species are recognized.

Chestnut (*Castanea vesca*) occupies about 1.3 per cent of the total forest area, or 240,000 acres, and occurs in Trans-Caucasia in the lower and to some extent in the middle altitudinal zone, seldom being found above 4,900 feet. There are no pure stands. Dimensions: 100 feet in height and 4⅔ feet in diameter.

Walnut (*Juglans regia*) occurs everywhere in Trans-Caucasia from sea level to 5,000 feet, but only in limited localities in a wild state.

Other species which may be mentioned are yellow locust, black locust, and sycamore.

Character of Ownership.—Before the war the forests of the Caucasus region were distributed by character of ownership as shown in Table 158.

The state owned nearly half of the forests.

TABLE 158.—PRE-WAR DISTRIBUTION OF FORESTS IN THE CAUCASUS

Provinces and Districts	State forests	Private forests
	acres	*acres*
Cis-Caucasia:		
Kuban	922,900	1,782,100
Stavropol	14,700	63,000
Terek	806,800	1,884,000
Trans-Caucasia:		
Black Sea	1,026,800	364,700
Baku	593,300	280,600
Daghestan	111,100	315,500
Yelisavetpol	1,072,700	173,800
Tiflis	1,300,700	2,108,500
Zakatalsky District	230,900	243,000
Kutais	710,300	1,608,400
Batum	699,000	351,000
Sukhum	450,200	810,000
Erivan	193,200	41,200
Kars	310,600	....
Total	8,443,200	10,025,800
Per cent	45.7	54.3

Annual Cut.—The lumber industry in the Caucasus region is poorly developed. There are practically no large-scale logging operations, and the timber is sold for the most part in small quantities to small lumbermen. How poorly the industry is developed may be seen from the fact that timber advertised for sale by the government often secures no bids at all. The reasons for this are the general industrial backwardness of the region, lack of transportation which would make possible export trade in timber, and the free use of timber by the local population in state and even private forests. There were in all 64 sawmills in the region, including 52 water mills, 11 steam mills, and 1 electric mill. The export trade is also very insignificant. Thus in 1908, 1,778,321 cubic feet was exported and 453,867 cubic feet imported, practically all of which was in the form of fuel wood from Persia for the city of Baku. The chief ports of export are Novorossisk, Batum, Baku, Sukhum, and Potti. In 1909 the amounts of timber which were allotted for cutting in the state forests and the amounts actually cut were as shown in Table 159.

Table 159.—Timber Designated for Cutting and Actually Cut—Caucasus

Provinces and Districts	Allotted for cutting	Actually sold
	cu. ft.	*cu. ft.*
Baku	18,407,840	3,611,960
Daghestan	1,669,580	800,580
Yelisavetpol	3,454,220	5,075,840
Kutais	63,532,700	3,235,100
Batum	21,343,740	6,262,960
Sukhum	12,160,500	117,700
Stavropol	2,035,000	2,973,960
Terek	24,938,980	13,966,260
Black Sea	28,648,620	373,780
Kuban	3,380,960	1,361,140
Tiflis	37,754,200	9,633,360
Zakatalsky District	13,863,960	704,440
Erivan	1,589,940	384,340
Kars	1,501,280	1,921,920
Total	234,281,520	50,423,340
Per cent		21.5

Thus ~~it~~ may be seen that in 1909 there was offered for sale 234,281,520 feet of wood, while the amount actually cut was 50,423,340 feet, or only one-fifth as much. Even in the provinces and districts which join the Black Sea, and from which the export by sea would be convenient, the amount of wood remaining unutilized is very large, as may be gathered from Table 160.

TABLE 160.—PROPOSED AND ACTUAL TIMBER SALES—BLACK SEA PROVINCES

Province	Allotted for cutting	Actually sold
	cu. ft.	*cu. ft.*
Kutais	63,532,700	3,235,100
Batum	21,343,740	6,262,960
Sukhum	12,160,500	117,700
Black Sea	28,648,620	373,780
Total	125,685,560	9,989,540

It is apparent that in the Black Sea provinces only 8 per cent of the timber that could be cut annually is actually cut. The cut per acre of state forests is about 6 cubic feet. The average cut per acre on private forests is probably three or four times as great, or say 20 cubic feet. The total cut for the entire Caucasus region is therefore in the neighborhood of 250,000,000 cubic feet, or an average of 14 cubic feet per acre.

Growth Exceeds Cut.—If we accept the amount of timber designated for cutting annually in the state forests alone as equal to the annual growth (and it is considerably below the actual growth), then the growth is five times the actual cut. The average annual growth per acre of state forests is at least 35 cubic feet. Over the forest area which is in private ownership, the cut is much greater, not so much because of cutting as through destruction by fire and other agencies. On the whole, however, the cut falls far below the annual growth. The annual growth for all state forests may be accepted as 300,000,000 cubic feet, while the annual growth in private forests is 200,000,000 cubic feet, or a total of 500,000,000 cubic feet.

Domestic Consumption.—Since the export is insignificant, being in the neighborhood of 2,000,000 cubic feet, and is still further somewhat balanced by imports of one-half million cubic feet, the total cut of 250,000,000 cubic feet may be considered as the approximate total consumption, or about 19 cubic feet per capita.

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SPAIN

Forest Area.—The total land area of Spain, not including the Balearic and Canary Islands and Spanish Africa, is 121,632,000 acres. The population in 1910 was 19,950,800.

Considerable difficulty is involved in interpreting the statistics on forest land in Spain, because of the interchangeable use of the terms *montes* and *forestal*. *Montes* may mean either high land or, by association, the forests which usually grow on such land. *Forestal* may be used to describe land on which trees are actually growing, or land naturally adapted to forest growth. Hence all figures on this point are necessarily somewhat doubtful.

The total forest area may be placed in the neighborhood of 16,886,000 acres. This represents approximately 14 per cent of the total land area of Spain, and a per capita forest area of 0.85 of an acre; the commercial forest area, however, must be much smaller. The timber of merchantable size covers only a little more than 5 million acres, the remainder consisting of small material suitable chiefly for fuel and charcoal. Even the 5 million acres classified as timbered land might perhaps be cut in half if the barren sections and the coppice were taken into account. The provinces of Santander, León, Teruel, and Cuenca, in the order named, are the most heavily forested. The entire productive forest area may therefore be placed at 8 million or at most 10 million acres.

An interesting comparison between an official "catalog of public forests," published in 1862, and the forest statistics of 1912-13, is contained in Table 161, which shows graphically the depletion of the pine and oak timber of the country in fifty years.

In fifty years the area of pine forests decreased nearly 2½ million acres, oak decreased nearly 3 million acres, and beech practically half a million.

Character of Ownership.—The area of forests declared to be of public character in 1913 and 1914 covered 11,886,349 acres in Spain and the neighboring islands. This area was distributed by ownership as follows:

	Acres
State	609,379
Communes	11,261,746
Other public bodies	15,224

There are also 5 million acres of private forests. The latter consist of cork, open stands of live oak, and pasture land with a scattered

TABLE 161.—DEPLETION OF FORESTS, SPAIN

Species	1862	1912–13
	acres	*acres*
Pine	5,666,054	3,242,233
Oak	4,164,252	1,233,866
Beech	1,039,529	599,808
Silver fir	159,866	....
Chestnut	1,363	172,544
Other species and clearings	1,211,933	....
Esparto fields	165,618	....
Total	12,408,615	5,248,451
Coppice	....	3,088,254
Thicket and pasture	....	3,550,238
Grand total	....	11,886,943

growth of trees and oak coppice. To these may be added a little pine and oak high forest.

Character of the Forest.—Spain is a very mountainous country, and hence should be abundantly forested. The present impoverished state of the forests, as in many other countries of Europe, is due to overcutting and to grazing. The latter practice is still general, especially in the mountain districts, where enormous herds of goats range almost unchecked. Goat grazing may be justly regarded as one of the chief causes of the present widespread poverty in Spain. The long and stormy history of the Iberian peninsula also accounts in part for the present condition. Hordes of conquerors swept over the country at various periods, from the Romans to the Moors, and each invasion was attended by the usual devastation. The results of denudation are everywhere apparent in the eroded, unproductive soil, the dry, harsh climate, and the dearth of water.

The public forests of Spain are divided officially into three regions: the "high mountain" forests, containing most of the merchantable timber; the "lower mountain" forests, containing smaller wood; and forest land producing chiefly fuel and brush. The distribution of these forests, by provinces and species, is shown in Table 162.

The principal species are pines, including *Pinus sylvestris, Pinus maritima, Pinus pinea,* and *Pinus laricio.* Oak is represented chiefly by *Quercus suber,* or cork oak. Other broadleaf species are beech, ash, walnut, chestnut, and sycamore. Lombardy poplar and eucalypts are planted artificially, the poplar being used for pulpwood.

Annual Cut.—There are no reliable figures of the total cut of wood in the forests of Spain. The annual cut of saw-timber before the war is estimated at 33 million cubic feet. This is evidently at the expense of the larger-sized trees, as during the war the increased cut in the Spanish forests threatened to destroy in a few years what remained of the mature and large-sized timber. In addition, there must be a large amount of wood cut for firewood, as the principal product of the forests is fuelwood.

With a productive forest area of about 8 million acres and a cut of 20 cubic feet per acre, the total annual production must be in the neighborhood of 160 million cubic feet. Of this 33 million cubic feet, or 20.6 per cent, is sawlog timber and 127 million, or 79.4 per cent, fuelwood.

Annual Growth.—The annual growth may be estimated at about 15 cubic feet per acre, which for the eight million acres of productive forest land would make 120 million cubic feet, or 40 million cubic feet less than the cut.

Domestic Consumption.—Spain imports annually an average of about 30 million cubic feet of lumber. This, together with 33 million cubic feet cut at home, constitutes a total consumption of construction timber of about 63,000,000 cubic feet, or 3.2 per capita. The total consumption of both construction timber and firewood must be about 190 million cubic feet, or 9.5 cubic feet per inhabitant. The consumption of wood increased 25 per cent during the five years immediately preceding the war.

Imports and Exports.—In 1913 the imports of wood and its manufactures were valued at $12,935,000. Most of the imports consist of

TABLE 162.—SPAIN—DISTRIBUTION OF PUBLIC FORESTS BY PROVINCES AND SPECIES

Province	Total area	Pine	Oak	Beech	Other species	Total	Per cent of forest
	acres	*acres*	*acres*	*acres*	*acres*	*acres*	
Santander	10,496,000	....	289,235	83,298	7,299	379,832	3.6
León	3,798,400	11,982	265,992	69,162	1,519	348,655	9.2
Teruel	3,660,800	345,061	....	....	....	345,061	9.4
Cuenca	4,248,960	318,647	....	....	....	318,647	7.5
Saragossa	4,304,640	296,788	12,721	1,657	1,729	312,895	7.3
Burgos	3,520,000	107,445	100,922	74,841	2,868	286,076	8.1
Oviedo	2,697,600	825	48,597	230,713	3,712	283,847	10.5
Huesca	3,742,720	194,061	8,363	16,534	2,100	221,058	5.9
Albacete	3,671,680	212,126	1,914	....	....	214,040	5.8
All other	....	1,756,061	499,414	117,602	155,462	2,528,539	....
Total area of high mountains		3,242,996	1,227,158	593,807	174,689	5,238,650	....
Forest area of lower mountains		....	....	....	....	3,088,785	....
Area of pastures and brushwood		....	....	....	....	3,558,914	....
Total, public forest		....	....	....	....	11,886,349	....

boards, planks, beams, logs, and ship timbers. In 1913 the imports of such wood amounted to over 21 million cubic feet, valued at $7,863,200. The imports and exports of wood are given in Table 163.

TABLE 163.—IMPORTS AND EXPORTS OF WOOD BY KINDS, SPAIN

Imports

Kind of product	1912	1913
	cu. ft.	*cu. ft.*
Staves, etc.	4,968,048	6,754,296
Railroad ties	1,402,631	1,354,596
Logs, etc	3,250,968	3,235,551
Boards over 40 mm. thick	12,211,117	14,965,506
Boards under 40 mm. thick	4,895,051	6,261,832
Partly manufactured wood	140,953	....
Fine wood over 40 mm. thick	338,665	427,265
Same 5–40 mm. thick	5,535	5,984
Same under 5 mm. thick	5,476	6,415
Hoops, etc	50,597	55,120
Pulpwood	567,810	1,278,812
Wood for casks	360,200	245,151
Ordinary carpenter wood	24,682	25,344
Ordinary manufactured wood	53,358	41,117
Fire wood	2,648	2,834
Furniture	22,868	16,783
Strips	5,524	6,329
Total	28,306,131	34,682,935

Exports

Kind of product	1912	1913
	cu. ft.	*cu. ft.*
Staves	50,877	45,255
Ties	1,978	3,119
Telegraph poles	1,211	2,073
Round timber	2,021,280	2,495,747
Boards and planks	128,955	127,450
Furniture wood, worked	90,270	113,632
Other wood, worked	81,167	87,210
Casks	1,774,656	1,769,633
Fuel	300,915	187,475
Total	4,451,309	4,831,594

The imports were distributed by countries of origin as shown in Table 164.

In 1913 the total export of wood and wood manufactures was valued at $2,487,000. This figure does not include exports of crude and manufactured cork, which amounted to $8,867,000.

Exports of certain kinds of wood and wood manufactures from Spain were restricted by royal decree during the war, owing to the serious shortage of such material within the country. Laws passed in 1915 and 1916 prohibited export of boxes and boxboards, railway ties, and logs over 10 inches in diameter. Export of pine mine timbers under 10 inches in diameter was limited to 62,000 metric tons a year.

Wood-Using Industries.—*Sawmills.*—The methods and equipment of the sawmills are primitive, because of the low per capita consumption of lumber.

Boxes.—There is a large demand for boxes and boxboards in Spain for use in the fruit-packing industries. It is said that between 25 and 30 million boxes are used annually in the large fruit-packing and shipping centers, and that 25 to 40 per cent of the total estimated cut of 200 million board feet of lumber is used for boxes and crates, in addition to the imports for this purpose.

Paper.—In 1901 the consumption of paper was 28,000 tons; in 1918 over 57,000 tons. The annual increase will probably be about 7 per cent. The consumption per capita, 4.4 to 6.6 pounds, is a very small figure as compared to the per capita consumption of the United States or England. Newspapers use 14,000 tons. The production of paper is about 15,000 tons, manufactured by La Papelera Española. There are about 12,100 acres of fir in the Pyrenees, chiefly in the provinces of Huesca and Lerida. These forests could produce 1,059,000 cubic feet of wood annually, which would make about 15,000 tons of mechanical pulp or 10,000 tons of chemical pulp. The forests, however, are not ready for immediate exploitation because of their inaccessibility. In the valley of Aran there is another area of 37,050 acres which could yield 423,600 cubic feet, capable

TABLE 164.—IMPORTS INTO SPAIN BY COUNTRIES OF ORIGIN

Countries of origin	Cu. ft.	Value
Austria-Hungary	1,542,480	$ 566,700
France	1,184,062	464,400
Portugal	1,090,193	406,300
Russia	7,187,258	2,613,300
Sweden	6,011,177	2,240,700
United States	3,888,497	1,421,000
Other countries	402,563	150,800
Total	21,306,230	$7,863,200

of making 6,000 tons of mechanical pulp or 4,000 tons of chemical pulp. In addition, according to official statistics, there are 1,482,000 acres of esparto fields producing 300,000 tons of esparto or 150,000 tons of pulp. It would seem, therefore, that there would be sufficient pulp material in Spain to supply the demand if transportation facilities in the Pyrenees and other mountain regions were developed.

Cork.—The chief article of export is cork. In 1919 the yield of cork was 80,000 metric tons, valued at $0.018 per pound. The total value realized in 1919 was $3,068,693. The chief centers of production were the provinces of Cadiz, Huelva, Badajoz, Caceres, Malaga, Seville, and Cordova.

Tables 165 and 166 give the imports and exports of cork in 1919 in metric tons.

TABLE 165.—EXPORTS OF CORK FROM SPAIN

Country	Raw cork	Cork in pieces	Stoppers	Other forms	Parings
	tons	*tons*	*tons*	*tons*	*tons*
Austria-Hungary	....	....	27.8	....	....
Argentina	....	299.3	184.2	....	....
Belgium	7.1	....	....	....	....
Brazil	....	....	28.9	....	....
Chile	....	....	57.4	....	....
Cuba	....	....	121.6	....	....
France	151.2	272.7	4,058.3	1,151.3	1,868.7
Germany	25.7	....	33.1	....	....
United Kingdom	4.3	....	239.0	269.7	5,809.1
Italy	....	236.2	100.0	....	....
Portugal	....	....	41.0	....	16.0
United States	1,122.9	10.2	304.7	1,790.0	24,623.2
Other countries	417.0	184.6	601.9	162.6	1,717.5
Total	1,728.2	1,003.0	5,797.9	3,373.6	34,034.5
Grand total	45,937.2				

Forestry Laws.—National forestry legislation (passed June 24, 1908) seeks to meet the fuel situation and to provide for conservation of woodlands by the acquisition of forests situated in flood areas and in other places where the permanence of the forests is essential to health, stability of the soil, uniformity of climate, etc. It also subjects private holdings located in such "protection zones" to any operations of the government, under penalty of expropriation. Further legislation is needed

TABLE 166.—IMPORTS OF CORK, SPAIN

Country	Metric tons
Algeria	399
France	209.1
Morocco	27.2
Portugal	1,084.7
Total	[1]1,720.0

[1]Valued at $89,637. To this must be added 13 tons of manufactured cork valued at $5,535.

to check reckless cutting of private forests, a matter which the present law does not cover.

The Forestry Movement.—Spanish forestry dates from the year 1848, when the Royal School of Forestry was founded. This school is still in existence at San Lorenzo del Escorial, north of Madrid, and graduates from 15 to 40 students each year. These graduates are employed in the state forests.

In June, 1913, the Royal Spanish Society of Friends of the Forest was established under the patronage of King Alfonso XIII. This association publishes at Madrid a forestry magazine, *"España Forestal."*

An effort is now being made to secure appropriation of funds for the purpose of extending the area of the state forests. It is said that as much as 62 million acres of mountain land could be utilized for purposes of scientific forestry. The present annual appropriation of about one million dollars falls far short of meeting the need for forest and stream protection and for replanting.

Some exotic trees have been successfully planted in Spain, such as California redwood, much used for ornamentation in parks and on private estates; eucalyptus, which is planted for mine timbers and various other uses; Lombardy poplar, used for pulpwood; and maritime pine, for reforestation in the mountain regions.

State forestry is under the jurisdiction of the Director General of Agriculture, Mines, and Forests.

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SWEDEN

Forest Area.—The total area of Sweden is 110,770,000 acres, of which 8.4 per cent is under water. The area of productive forest land is 55 million acres, or about 55 per cent of the total land surface of the country. This represents a forest wealth of 9.6 acres per inhabitant as compared to 1.70 acres for Europe as a whole and 0.91 acre for western Europe. Thus Sweden for its size is one of the richest countries of the world in timber and, with the exception of Finland, has the highest percentage of forested area in Europe. Natural conditions combine to make Sweden a country of forests. The soil and climate are particularly well adapted to forest growth; in fact a large part of the soil is unfit for any other kind of vegetation. The proportion of forested to nonforested area in each province is shown by the figures for 1915, in Table 167, which are taken from the Statistical Yearbook of Sweden for 1918 and 1919.

About 65 per cent of the productive forest land in Sweden is located in northern Sweden (the region north of the Dal River). The provinces having the largest acreage of productive forests in proportion to their total area are Vermland, Kopparberg, Gevleberg, and Vesternorrland. The provinces farthest south are now more sparsely forested. Most of the forests have been cleared during the last few centuries for agricultural use. The tendency is to retain the present forest area by preventing forest devastation on privately owned timberlands and by increasing the public forests through purchase.

Character of the Forest.—About 85 to 90 per cent of the forests in Sweden are softwoods (pine and spruce), and from 10 to 15 per cent hardwoods (chiefly birch).

Four forest regions may be roughly distinguished:

1. The northernmost region of birch forests.
2. The northern region of coniferous forests.
3. The southern region of coniferous forests.
4. The region of beech forests.

1. The birch forests are found in Sweden above 1,500 feet in northern Lapland, and above 3,000 feet in northern Dalarne (their southern limit). They have their greatest extension in the north, stretching for some 20 miles with a vertical range of 450 to 650 feet. These forests are usually thin and low and in addition to birch contain aspen and mountain ash.

2 and 3. The northern and southern regions of coniferous forests are

the great timber regions of Sweden. The boundary between the northern and southern regions is formed by the northern limit of pedunculate oak. In the northern coniferous region besides Scotch pine and common spruce, which are the dominant trees, birch, aspen, willows, wild cherry, and mountain ash occur extensively. In the southern belt of coniferous forest, besides pine and spruce, oak, elm, maple, and ash are fairly common.

4. The beech region. The beech forest begins at the southernmost limit of spruce. Although most of this region has been brought under the plow, the parts which are not yet cleared are covered with beech

TABLE 167.—AREA OF PRODUCTIVE FOREST, SWEDEN

Province	Productive forest area[1]	Ratio of land under forest to the total area of each province
	acres	*per cent*
City of Stocklohm	15,000	45.5
Rural District of Stockholm	1,135,000	62.2
Upsala	695,000	54.9
Sodermanland	996,000	64.4
Ostergötland	1,547,000	62.8
Jönköping	1,400,000	53.4
Kronoberg	950,000	43.2
Kalmar	1,671,000	61.7
Gotland	384,000	49.9
Blekinge	357,000	49.9
Christianstad	643,000	41.7
Malmohus	141,000	12.1
Halland	346,000	29.3
Göteborg and Bohus	416,000	34.4
Elfsborg	1,853,000	64.2
Skaraborg	767,000	38.4
Vermland	3,363,000	77.6
Orebro	1,333,000	64.6
Vestmanland	912,000	57.3
Kopparberg	5,114,000	73.3
Gevleborg	3,669,000	81.6
Vesternorrland	4,706,000	78.9
Jemtland	7,308,000	62.1
Vesterbotten	7,410,000	54.0
Norrbotten	8,419,000	34.5
Total	55,550,000	54.8

[1] The Swedish Forest Service gives slightly different figures, which have been used in Table 169 and other calculations below.

forests in which both pedunculate and sessile oaks are common. The most common and the most desirable species commercially, however, are pine and spruce.

Pine (*Pinus sylvestris*).—Of this there are two varieties, *Pinus sylvestris lapponica* and *Pinus sylvestris septentrionalis.* The average age at which suitable sawlog timbers can be sawed from trees ranges from 80 to 180 years according to the geographical location. In southern Sweden maturity is reached at from 80 to 90 years, in central Sweden and southern Norrland, 90 to 120 years, and in central and northern Norrland 120 to 180 years.

Spruce (*Picea excelsa*).—The age at which spruce is considered merchantable is reached earlier than in the case of pine; namely, about 80 years.

There are some plantations of larch, both European and Siberian, but for the present they are of no commercial importance. Birch is the only hardwood of any consequence and is used locally as a general utility wood and for firewood. Other hardwoods are inferior in quality to the hardwoods imported from abroad.

Stand.—The total amount of standing timber in Sweden has been estimated at from 37,100,000,000 cubic feet to 46,000,000,000 cubic feet. These estimates, however, are only approximations. The average stand and the annual increment in the various sections of the country are given in Table 168.

TABLE 168.—AVERAGE STAND AND ANNUAL GROWTH OF TIMBER, SWEDEN

District	Stand per acre	Annual increment per acre
North of 64° north latitude:	*cu. ft.*	*cu. ft.*
Coastal district	858.0 to 929.5	14.3 to 17.9
Interior district	429.0 to 715.0	7.2 to 10.7
62° to 64°	715.0 to 929.5	21.5
60° to 62°	786.5 to 1,144.0	28.6
South of 60°	858.0 to 1,287.0	28.6 to 42.9
Average	786.5 to 929.5	21.5 to 28.6

In 1908 Sweden's national wealth was calculated at $3,752,000,000, and the value of the forests at $417,276,000, or 11 per cent of the total, as follows:

Forests belonging to the state	$61,640,000
Other public forests	21,172,000
Private forests	334,464,000

Character of Ownership.—Of the total productive forest area, 23.6 per cent, or 12,900,000 acres, is owned entirely or partly by the state, and 76.4 per cent, or 42,400,000 acres, is privately owned.

Public Forests.—At the beginning of the 19th century the Swedish government, acting upon the theory prevalent at that time in Europe that government forest exploitation is inefficient, sold large areas of forest lands to private individuals at extremely low prices or gave concessions to sawmills. Since 1860, however, the government has adopted a new policy with regard to the management of its forests and has begun to increase the area of state forests partly by purchase and partly by taking in other public forests. In 1870 the area of public forest lands was about 1,053,000 acres; in 1915 it was 12,900,000 acres. The public forests of Sweden are of two classes:

1. Forests owned entirely by the state, the income from which goes to the government alone;

2. Communal forests, county forests, municipal forests, and church forests. The state controls the cutting and, to some extent, the management of this class of forests, but does not obtain the revenue from them. The area of productive state-owned forests is about 10,000,000 acres, while other public forests cover about 3,000,000 acres.

Private Forests.—One-third of the privately owned forests are in the hands of wood-using industries, and about two-thirds belong to farmers and other individual owners. Several sawmill companies in Sweden possess as much as 1,000,000 to 1,500,000 acres of forest. The bulk of the large private holdings is in northern Sweden. The private forests have been greatly overcut in the past, particularly in southern Sweden and the coastal regions.

Annual Growth.—The total gross annual increment is placed at 1,514,305,000 cubic feet, or 27.4 cubic feet per acre. Waste due to improper utilization, disease, insects, and fires is estimated at 202,225,000 cubic feet, leaving a net annual increment of 1,312,080,000, or 23.6 cubic feet per acre. The annual increment in the different provinces of Sweden is given in Table 169.

Annual Cut.—The total annual cut before the war amounted to 1,564,826,000 cubic feet, or 28.2 cubic feet per acre of productive forest land.

The amount of timber cut for different purposes was estimated by the forest commissions before the war as shown in Table 170.

Annual Cut and Annual Growth Contrasted.—Comparing the annual increment and the annual cut there was before the war an excess of cutting above increment of not less than 252,746,000 cubic feet a year.

Domestic Consumption.—Of the total cut of 1,564,826,000 cubic feet, 303,185,000 cubic feet is exported in the form of logs, round and hewn

TABLE 169.—GROSS AND NET ANNUAL GROWTH, SWEDEN

Province	Productive forest area	Gross annual growth		Deduction for waste	Net annual growth	
		Per acre	Total		Total	Per acre
	acres	*cu. ft.*	*cu. ft.*	*per cent*	*cu. ft.*	*cu. ft.*
Norbotten and Vesterbotten:						
Interior districts (two-fifths of total area)	6,328,000	11.4	72,336,000	25	181,405,000	8.6
Lower districts (three-fifths of total area)	9,495,000	17.9	169,537,000			13.4
Jemtland, Vesternorrland, Gevleborg, and Kopparberg	20,898,000	28.6	597,077,000	15	507,515,000	24.3
Forest area south of above provinces, except provinces of Skane,[1] Halland, and Blekinge	17,199,000	35.7	614,252,000	8	565,112,000	32.9
Skane, Halland, and Blekinge	1,425,000	42.9	61,103,000	5	58,048,000	40.7
Total, Sweden	55,345,000	27.4	1,514,305,000	13	1,312,080,000	23.7

[1] Skane is an old province, now included in Christianstad and Malmohus.

timber, sawn lumber, and other semi-manufactured wood products. This leaves 1,261,641,000 cubic feet for domestic use. To this must be added about 17 million cubic feet imported annually into Sweden, making a total of 1,278,641,000 cubic feet of wood consumed annually, or 220.5 cubic feet per inhabitant. If, however, we deduct 323,245,000 cubic feet of wood used for pulp manufacture and firewood used in the manufacture of pulp, the bulk of which is also exported, 198,630,000 cubic feet of wood used for charcoal for export, and 7,056,000 cubic feet of wood used for the manufacture of wood tar for export, the domestic consumption shrinks to 749,710,000 cubic feet, or 129.3 cubic feet per capita.

Loss from Fire and Other Agencies.—Because of abundant precipitation and efficient fire patrol systems by both private owners and the government, forest fires in Sweden are limited. The damage in any one year seldom exceeds $250,000. It is estimated that the burned area in public forests averages from 10,000 to 12,000 acres a year and in private forests from 30,000 to 40,000 acres.

Wood-Using Industries.—Among the wood-using industries of Sweden, the lumber industry is first in importance, and the wood pulp and cellulose industry next. Other industries using important quantities of wood are wood alcohol distillation, cooperage, and the manufacture of charcoal, furniture, wood tar, matches, boxes, and wooden shoes. Minor industries are those for the utilization of wood waste and the by-products of the cellulose industry. Most of the raw material used in the Swedish mills is softwood, chiefly Scotch pine and spruce, though staves are made from the wood of deciduous trees.

TABLE 170.—ANNUAL CUT OF TIMBER, SWEDEN

Kind of material		Cu. ft.
1. Domestic consumption		732,710,000
2. Exports of wood, total		303,185,000
	cu. ft.	
Logs, round and hewn timber (including loss of sunken logs, etc., 15 per cent)	54,598,000	
Sawn lumber (including sunken logs, shrinkage when drying, sawmill waste, etc., 25 per cent)	210,869,000	
Semi-manufactured (including sunken logs, shrinkage when drying, sawmill waste, etc., 30 per cent)	37,718,000	
3. Wood, including firewood, used for pulp manufacture		323,245,000
4. Wood used by mines, in smelting ore, and for charcoal for export		198,630,000
5. Wood used for manufacture of wood tar for export		7,056,000
Total cut		1,564,826,000

Lumber Industry.—Lumbering is a very old industry in Sweden, but it did not become a great industry until steam sawmills were built on the coast. This revolutionized lumbering by doing away with long distance transport to the coast from the mills, and by increasing the capacity for production and improving the quality of the output. It also did away with interruptions, so common with water power mills, due to freezing of the streams in winter. Toward the middle of the 19th century liberal commercial laws came into force, export dues were suppressed, and the demand for sawn timber increased greatly. All these circumstances favored the development of the industry.

In 1913 there were in Sweden 1,053 industrial sawmills and machine planing mills, not including small domestic mills run either by steam or by water power. The number of workmen employed in the lumber industry was 44,150; frames in use, 1,659; planing machines in use, 905; output, 241,926,962 cubic feet.

Pulp and Paper Industry.—The first factory for the manufacture of wood pulp and cellulose was built in 1857. The industry is now carried on throughout the country, some of the sawmills being engaged in making wood pulp as a side line. In 1913 there were 167 wood pulp factories making mechanical and chemical pulp of all kinds. The output of these factories is estimated at 1,186,627 tons, distributed as follows: mechanical pulp, 326,098 tons; bisulphite pulp, 705,099 tons; sulphate pulp, 155,430 tons. The total value of the output is placed at about $33,768,000.

Paper making is not so extensive as the large production of wood pulp would seem to indicate, owing to the small supply of coal in Sweden. Yet two kinds of cheap paper are exported in large quantities: newsprint, valued at over $2,430,000, and wrapping paper, valued at over $4,860,000.

Match Industry.—The machine used in making the famous Swedish safety matches can turn out as many as 66,000 packed boxes in a ten-hour day. Matches were formerly made from aspen, but the supply is now practically depleted, and birch is used as a substitute. Great Britain buys about 37 per cent of the total export of safety matches.

The manufacture of *charcoal* ranks next to the wood pulp industry in consumption of raw material. The woods used for this purpose are spruce and pine. The total amount of charcoal produced in 1913 was 114,054,000 bushels.

Wood distillation includes the preparation of tar, black pitch, rosin, turpentine, methyl alcohol, and acetone. The manufacture of wood tar, which was formerly an important industry throughout the country, is now carried on only in the extreme northern provinces.

Sawmill waste is utilized in preparing wood pulp, charcoal, and tar.

Export Trade.—The export of forest products in 1912 formed not less than 43 per cent in value of the total export from Sweden. The export of timber and lumber (exclusive of pulp and paper) constitutes 19.4 per cent of the total cut of wood.

Natural conditions in Sweden are favorable to a flourishing export trade. The country has a long coast line, connected with the interior by many canals and navigable waterways, and a large number of easily accessible, well-protected harbors. The railway mileage in 1913 was nearly 9,000 miles, or more than 16 miles per 10,000 inhabitants. No other country in Europe is so well provided in this respect. Electric railways are coming more and more into use because of the unusual facilities for producing electricity by water power.

While the exports of forest products from Sweden are valued at nearly $82,620,000 a year, the imports of these materials amount to not more than $4,860,000. From 1863 to 1912 wood and wood products exported from Sweden amounted to $1,792,920,000. In 1913 the net export, including rough, squared and sawn timber, mine wood, etc., to the various countries, was as given in Table 171.

Table 171.—Exports of Timber from Sweden

Country	Cu. ft.	Per cent
Norway	13,470,798	5.5
Denmark and Iceland	27,840,051	11.5
United Kingdom	91,970,620	37.9
Netherlands	12,659,498	5.2
Germany	25,749,762	10.6
France	33,485,827	13.8
Italy	523,781	0.2
Other countries of Europe	15,445,515	6.4
Egypt	3,303,092	1.4
British Africa	5,906,926	2.4
Australia	3,486,687	1.4
Others	8,944,632	3.7
Total	242,787,189	100.0

The growth in value of the export trade may be learned from Table 172.

The timber export of Sweden consists almost exclusively of pine and spruce. Of the entire export of timber and lumber, rough lumber constitutes 64.1 per cent, surfaced lumber 10.9 per cent, round timber 11.2 per cent, hewn timber 7.9 per cent, and firewood 5.9 per cent.

Table 172.—Value of Exports from Sweden

Year	Sweden's total export	Wood and timber[1]	Wood pulp	Goods manufactured of wood pulp	Total wood, timber, and pulp
1863	$ 24,796,432	$ 3,222,421	....	....	$ 3,222,421
1870	40,870,536	14,499,533	....	....	14,499,533
1880	63,420,324	23,921,776	$ 597,621	$ 1,770,267	26,289,664
1890	81,630,656	28,841,142	1,157,251	5,715,231	51,890,386
1900	104,877,512	41,012,108	7,163,047	3,715,231	51,890,386
1912	203,845,356	44,152,574	25,179,868	10,552,316	79,884,758

[1] Goods manufactured of wood not included.

Rough and Planed Lumber.—Export of rough and planed lumber of pine and spruce in 1913 was distributed among the countries of destination about as follows:

Table 173.—Exports of Rough and Planed Lumber

Country	Percentage	Country	Percentage
United Kingdom	28.8	Norway	3.5
France	19.6	All other countries in Europe	1.2
Germany	12.6	British South Africa	3.3
Denmark	10.5	Algiers, Tunis, and Morocco	2.7
Holland	5.9	All other countries in Africa	2.2
Belgium	3.3	Australia	2.0
Spain	3.6	All other countries	0.8

Logs and Round Timber.—The export of sawlogs and round timber is at present very small. The only timber of this kind exported is that shipped to Norway, particularly from regions connected with Norway by floatable rivers.

Props.—The export of props is at present unimportant and the shipments will decline still further in years to come. The production of props for export has been a menace to Swedish forests for a long time, as they were cut from immature timber and led to the devastation of the forest. Sweden has recently passed a law which curtails the production of props. Laws similar to those of Sweden are now in effect in Finland and Norway. Before the war the production of props was transferred to Russia, where the cutting regulations were less strict. Should

Russia also place an embargo on the shipment of props, England may have difficulty in securing mine timber.

Pulpwood.—Sweden, with an important pulp industry, does not export large quantities of pulpwood, since the Swedish pulp plants are in need of all the pulpwood at home. The only pulpwood exported from Sweden goes to Norway and is shipped only from such regions as are more accessible to Norwegian points than to the nearest Swedish pulp mills.

Railroad Ties.—Sweden exports only a small quantity of railroad ties, as even Swedish railroads at times have difficulty in obtaining the number of ties necessary for their operation.

Revenue.—The gross revenue from the state forests, the expenditures, the net revenues, and the net revenues per acre from 1911 to 1915 are given in Table 174.

TABLE 174.—REVENUE FROM STATE FORESTS

Year	Gross revenue	Expenditures	Net revenue	Net revenue per acre of productive forest
1911	$3,458,612	$1,044,159	$2,414,453	$0.27
1912	3,772,362	1,159,676	2,612,686	0.28
1913	4,940,457	1,415,206	3,525,251	0.38
1914	4,957,747	1,686,512	3,271,235	0.35
1915	7,171,237	1,857,968	5,313,269	0.57

Since 1915 the revenue from the state forests has further increased.

State Forests.—The public forests are divided into ten districts and are managed by the Swedish Forest Service, which is a part of the Department of Agriculture. At the head of the Forest Service are a general director and six assistant directors. At the head of each district there are a district forester and a number of assistant foresters, forest engineers, and other assistants. The Swedish Forest Service has complete control over the government forests and either supervises or manages the other public forests. It also executes the laws in regard to the management of private forests and cutting. The policy of the Swedish government is to bring into solid blocks small parcels of forests in the southern part of the country by purchases of intermediate sections. The government also purchases extensive areas of cut-over or burned forest lands with a view to the reforestation of these areas, particularly in the coastal regions of southwestern Sweden. From 1875 to 1915 the government purchased nearly one million acres of land at a total value of

$7,715,000. The total cut of sawlogs in the state forests in 1915 was estimated at 53 million cubic feet, or about 17 per cent of the total quantity of sawlogs produced for sawn lumber for export in the country. The following table gives an idea of the amount cut in 1915 in each of the ten districts into which the state forests are divided:

Table 175.—Timber Cut from State Forests

District	Area	Cut in 1915	Cut per acre
	acres	cu. ft.	cu. ft.
Lulea	2,882,000	27,553,000	9.6
Skelleftea	2,152,000	32,800,000	15.2
Umea	1,751,000	34,407,000	19.6
Central Norrland	572,000	20,136,000	35.2
Gevle-Dala	917,000	26,447,000	28.8
Bergslag	209,000	7,766,000	37.2
Ostra	156,000	5,123,000	32.8
Vestra	164,000	5,895,000	35.9
Smaland	208,000	6,731,000	32.4
Sodra	132,000	3,407,000	25.8
Total, Sweden	9,143,000	170,265,000	18.6

Forestry Movement.—State forests in Sweden, as well as private forests, are subject to a special regulation adapted to the conditions in each part of the country. The first laws regulating cutting in the provinces of Norrbotten and Vesterbotten were passed in 1866 and 1873. These laws stipulated that cutting must be done only after the trees have been marked by a government forester. In 1874 and 1882 so-called "diameter limit laws" were adopted and applied to the coastal districts of the provinces of Norrbotten and Vesterbotten. The laws stipulate that no timber less than 7 inches in diameter at 16 feet from the ground may be cut except by special permission.

The islands of Gotland and Oland in the Baltic Sea are protected by a special law passed in 1869. Cutting in the forests of these islands is permitted only when the land cut over is to be utilized for agricultural purposes. Cutting for other purposes can be done only by special permission. After cutting the owner must take the necessary steps for reforesting the cut-over areas. In 1903 a law was passed regulating the cut of private forests in other parts of Sweden. The essence of this law is that forest lands in private ownership must not be cut in such a way as to endanger the reproduction of the forests. If the forests are cut recklessly the owner must reforest the land. In 1918, as a result of excessive cutting brought about by the demands of war, a new law was passed which provides that no young forests shall be cut unless such cutting is in the nature of a thinning and is aimed at the improvement of the remaining stand. In addition, there are still other special laws, the object of which is to conserve the forests adjacent to agricultural land and lands close to the sea which serve as a protection against sand storms. These protection areas are located mainly in the province of Jemtland and on the southwestern coast of Sweden. The forests in these territories must be cut only for the personal needs of the owner and under the supervision of a trained forester.

Since 1903 the enforcement of the forest laws is entrusted to a forest commission in each province. A commission consists of three members serving for a term of three years, a chairman appointed by the national government, one member appointed by the provincial government, and one member appointed by a local association. The expenses of these commissions are defrayed partly by a special tax in the nature of a severance tax, amounting to 1.3 per cent of the stumpage values of the timber cut. Ninety per cent of the amount collected in this way is used in the province in which it is collected, and 10 per cent goes to make up a central fund for the whole country. In addition, the forest commissions receive appropriations from both the provinces and the government. The total income of these commissions both from tax and from special appropriations is about $440,000.

Education.—Sweden, since 1828, has had a college of forestry, which in 1915 was reorganized and provided with magnificent buildings and equipment. The college is located on the outskirts of Stockholm. This institution is for the training of higher forest personnel. There are seven other forest schools in different parts of the country for the training of the lower forest personnel. A unique forest school is the Erickson Institute of Forest Management and Sawmilling in Hernosand. This institution, intended chiefly for forest sawmill operators, lays stress upon logging and milling.

Forestry Associations.—There are several associations engaged in the promotion of forestry, the most important of which is the Swedish Forestry Association, founded in 1902. It issues numerous publications of a technical and popular nature. Another organization of importance is the Association of Forestry in Norrland, the chief object of which is forest propaganda. There are also several smaller associations working for better forest management in southern Sweden.

Probable Future.—Sweden, Russia, and Finland are the only countries in Europe which still have large supplies of timber for the needs of the world. Having abundant forests, together with effective forest laws which safeguard their perpetuation, Sweden will continue to play an important part in the international timber trade. There are still large areas in northern Norrland chiefly of pine, the bulk of which is owned by the government, which will be a source of sawlog material. In the rest of the country, however, the pulp industry will take precedence over the lumber industry. Since the pulp mills are controlled wholly or in part by the lumber mills, they can easily change from one industry to the other when conditions warrant. The small size of the timber, however, and the great demand for pulp and paper make the further expansion of the lumber industry doubtful. For the next 5 or 10 years one may count on an annual lumber export from Sweden of 1,800,000,000 to 2,000,000,000 feet, board measure, if the foreign markets can absorb such an output. The only serious competitor of Sweden is Russia. Unless Russia can increase her imports materially over the prewar figures, Sweden will be able to hold her present markets.

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SWITZERLAND

Forest Area.—The total area of Switzerland is 10,200,000 acres. Of this about 2,320,000 acres, or 22.7 per cent, is under forest, 5,312,500 acres, or 52.1 per cent, is used for agricultural purposes; and 2,567,500 acres, or 25.2 per cent, is classed as unproductive—that is, occupied by glaciers, snowfields, lakes, streams, rocks, railways, and buildings. There are, therefore, only 7,632,500 acres of productive soil in the entire country. The proportion of unproductive to productive area varies greatly in the different cantons; for instance, in Uri over half of the land, or 55.6 per cent, is unproductive; in Valais, 45.1 per cent; in Grisons, 40.6 per cent; Glarus, 35.1 per cent; Tessin, 33.2 per cent; and Basel (city), only 3 per cent.

The forested area of Switzerland in relation to the total area, by cantons, is shown in Table 176.

The area of forest per capita varies greatly, depending on the manner of life of the people, the general state of progress of culture, the availability or lack of substitutes for wood for heating purposes, etc., and the region. For instance, the canton of Bâle-Ville has the densest population, 15 inhabitants per acre and 0.01 of an acre of forest per inhabitant. Geneva has a population of 2 per acre, and 0.05 of an acre of forest per capita. In Zurich there is one inhabitant per acre, and 0.25 of an acre of forest per capita; while Grisons has 0.06 inhabitant per acre and 2.79 acres of forest per capita. The average for Switzerland as a whole is 0.36 inhabitant per acre and 0.62 acre of forest per capita. Table 177 shows in round numbers the fluctuations in these figures from 1870 to 1910.

The forest area of Switzerland is shown to have increased, but

Table 176.—Forest Area in Relation to Total Area

Canton	Total area	Forested area	Ratio of forest to total area
	acres	*acres*	*per cent*
Zurich	427,088	117,868	27.6
Bern	1,700,229	440,757	25.9
Lucern	368,596	87,601	23.8
Uri	265,372	38,357	14.4
Schwyz	224,274	46,614	20.8
Unterwalden, Obwald	121,746	38,073	31.3
Unterwalden, Nidwald	67,866	17,045	25.1
Glarus	169,076	25,024	14.8
Zug	59,297	12,921	21.8
Fribourg	412,759	90,491	21.9
Soleure	195,476	72,606	37.1
Basel, town (Bâle-Ville)	9,156	924	10.1
Basel, country (Bâle-Campagne)	105,462	36,652	34.7
Schaffhausen	73,636	30,043	40.8
Appenzell, Outer Rhodes	59,895	14,531	24.3
Appenzell, Inner Rhodes	42,630	9,119	21.4
St. Gall	497,376	109,670	22.0
Graubunden (Grisons)	1,757,035	362,146	20.6
Aargau	346,647	113,790	32.8
Thurgau	248,425	46,572	18.8
Tessin (Ticino)	694,917	156,704	22.6
Vaud	793,458	209,147	26.4
Valais	1,293,094	198,736	15.4
Neuchâtel	197,501	60,520	30.6
Geneva	69,681	6,328	9.0
Total	10,200,692	2,342,239[1]	23.0

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[1] The total area given here is slightly greater than the figure used elsewhere in this discussion, being based on more recent statistics.

not in proportion to the population, so that the area per capita has decreased.

Character of Forest.—Switzerland is divided naturally into three principal climatic and topographic zones, which show marked differences in the character of their forest vegetation. These are the Jura region, the plateau or hill region and the Alps region. The Jura region contains mixed broadleaf and coniferous forests. Beech is one of the most important species in these stands, preserving the soil from drying and serving as a shelter for more exacting species, such as ash, maple, fir, and spruce. Beech is nearly always mixed with Scotch pine on southern slopes. The latter does not occur in extensive tracts, but is to be found throughout Switzerland. Fir and spruce, more exacting trees, are found on fertile northern slopes, although they also occur in important stands on the lower terraces of southern slopes, especially where there are glacial deposits. Oak also has a preference for those warm, fertile sites. Fine specimens of oak are found in the Jura of Schaffhausen at an altitude of 2,300 feet. Other valuable species of this region are maple and ash, while sorbus and yew occur more rarely.

The plateau region is the natural stronghold of broadleaf species. The original forests of this zone consisted of oak, beech, ash, hornbeam, maple, linden, alder, poplar, and willow, with a slight admixture of white fir and Scotch pine. At the present time spruce occupies an important place, having increased within the last century at the expense of oak and fir.

Spruce and fir increase rapidly in quality in the Alps region. They are at their best and form the dominant species along the north edge of the Alps. Spruce alone is found at an altitude higher than 5,000 feet above sea level. Larch, mountain pine, Cembran pine, and Scotch pine also reach their maximum development in the forests of the Alps. The latter species occurs mainly on slopes south of the foehn regions (Reuss

Table 177.—Fluctuations in Forest Area

Year	Forest area	Population	Per capita forest area
	acres		*acres*
1870	1,896,960	2,655,000	0.71
1880	1,934,010	2,831,000	0.68
1890	2,037,750	2,918,000	0.70
1900	2,114,320	3,315,000	0.64
1910	2,218,060	3,742,000	0.59

valley). Beech is fairly well represented in some places, and chestnut grows in unmixed coppice in southern Tessin.

The proportions of coniferous and broadleaf species in the forests of Switzerland as a whole are approximately as follows:

	Per cent
Coniferous	70
Spruce	40
Fir	20
Pine, larch, etc.	10
Broadleaf	30
Beech	25
Oak, ash, maple, alder, birch	5

Of the total forest area possibly 20 per cent, or 464,000 acres, is in the Jura region; 25 per cent, or 581,000 acres, in the plateau region; and 55 per cent, or 1,275,000 acres, in the Alps. Three-fourths of the Swiss forests are thus to be regarded as mountain forests.

Character of Ownership.—A very small proportion of the public forests of Switzerland is owned by the Confederation—only about 104,400 acres, or 4.5 per cent of the forest area. Of the rest, 1,577,600 acres, or 68 per cent, belongs to the cantons. The remainder, amounting to about 638,000 acres, or 27.5 per cent, is owned by private individuals. Public forests form, therefore, nearly three-fourths of the forest domain of Switzerland. This fact is of the greatest importance for the communes from a financial standpoint, since the forest is in many cases their principal or only resource.

The separate regions or cantons of Switzerland show marked differences in the distribution of ownership, as in other respects. The cantons of Schwyz, Glarus, Zug, Bâle-Ville, and Tessin have no state forests at all, and there is a very small proportion of such forests in Uri, Lower and Upper Unterwalden, Bâle-Campagne, Appenzell (Inner and Outer Rhodes), Grisons, Valais, and Geneva. State forests are to be found chiefly in Bern, Vaud, Freiburg, Aargau, Neuchâtel, and Schaffhausen; in the latter canton they comprise 19.7 per cent of the total forest area. The communal (and corporation) forests are also unevenly distributed. In Valais they are important, forming 94 per cent of the total forest area, while in Geneva they occupy only 7 per cent of the total. The same is true of private forests, which are represented by 76 per cent in Lucern, 52 per cent in Zurich, 10 per cent in Grisons, and only 6 per cent in Valais.

It is regarded by authorities as a fortunate circumstance that the forests of the mountain regions are public, since they are much more likely to be preserved than they would be if privately owned. This is most important in places where the forests serve as protection against erosion and other disasters.

ized cutting. Much damage had already been done, however, the effects of which will be felt for many years.

The situation in the public forests fortunately is better. Stricter supervision is possible, and cutting can be so regulated as not to exceed the annual growth.

Imports and Exports.—Before the war, the average annual import of wood into Switzerland was about 24,000,000 cubic feet, of which 70 per cent was timber and the rest fuel. In the year 1913 Germany furnished the greater part of this import, or 48 per cent; Austria-Hungary followed with 31 per cent, these two countries together furnishing almost four-fifths of the total import. It is therefore interesting to note the change which the war produced in this respect. During the years immediately preceding the war, and including part of 1914, the import of woods decreased and exports remained practically stationary. But from 1914 to 1916 Switzerland became a wood-exporting country. The excess of import over export in 1914 amounted to $3,904,390, while in 1915 export exceeded import by the amount of $1,721,560. From that time on the excess of export over import increased in value, and in 1918 it was more than triple the highest excess of import ever known. Beginning in 1917, and continuing through 1919, there was a general downward trend in the volume of export of wood and wood products. Meanwhile, imports of wood merchandise of all kinds increased.

Table 179 summarizes the amount and value of imports and exports of wood and wood products (charcoal and paper pulp) for 1911 to 1918, inclusive.

TABLE 179.—IMPORTS AND EXPORTS, SWITZERLAND

Year	Imports		Exports	
	Metric tons	Value	Metric tons	Value
1911	499,290	$ 9,993,540	69,967	$ 1,872,100
1912	487,456	10,279,180	69,873	1,893,330
1913	420,329	8,733,250	80,141	2,117,210
1914	315,009	5,724,380	73,592	1,819,990
1915	152,589	3,607,170	223,117	5,328,730
1916	141,709	4,705,340	527,261	15,509,480
1917	79,242	3,773,150	421,797	16,740,820
1918	55,616	4,527,780	348,875	25,365,990

That Switzerland is rapidly returning to the status of a wood-importing country is shown by the fact that during the first three quarters of 1919 the excess of imports over exports was 6,596 metric tons. It is interesting to note that Germany furnished 50 per cent of the imports into

Switzerland during 1911–1918; other countries furnishing wood were Austria-Hungary 17 per cent, Sweden 13 per cent, Spain 10 per cent, France 6 per cent, Italy and Russia each 2 per cent, and some other countries less than 1 per cent each.

Wood-Using Industries.—In the year 1905 a census was taken of all the agricultural, manufacturing, and commercial industries of Switzerland. The following data on wood-using industries of the country are taken from the reports of that census.

The most important wood-using industries of Switzerland, together with the number of establishments and the number of persons employed in each, are summarized in Table 180.

TABLE 180.—WOOD-USING INDUSTRIES, SWITZERLAND

Kind of industry	Number of establishments	Number of employees	Kind of industry	Number of establishments	Number of employees
Sawing	1,900	5,899	Turning	585	1,260
Felling	112	246	Cooperage	2,111	3,193
Treating	23	212	Pulp and paper	53	4,153
Carpentry	3,951	13,316	Vehicles	3,426	5,838
Parquetry	130	1,506			
Joining	7,803	23,821	Total	20,094	59,444

According to this report, wood industries comprised 15.4 per cent of all the industries of the country, and employed 9.5 per cent of the industrial population.

The table given below contains a summary of the amount of wood consumed annually by wood-using industries:

Kind of material	Cu. ft.
Building material:	
Resinous	66,580,213
Broadleaf	6,252,865
Ties, stavewood, etc.:	
Resinous	537,972
Broadleaf	620,398
Boards, etc.:	
Resinous	16,058,500
Broadleaf	2,037,163
Total	92,087,111

Most of the sawmills of Switzerland (79 per cent) are run by water power; electricity takes second place as a motor force, followed by gas, petrol, benzine, etc. Steam power is used in only 355 establishments.

Forestry Laws.—Three-fourths of the forests of Switzerland are regarded at the present time as protection forests; that is, they are located in the basins of torrents, where they serve to lessen the harmful effects of runoff, or they afford protection against avalanches or against severe climatic conditions. Since the maintenance of such forests is conceded to be essential to the general welfare, federal laws have been in force since 1876 which forbid cutting except with the consent of the forest administration, and as a rule clean felling is forbidden altogether. The effect of these provisions has been very satisfactory, the area of protection forests has been maintained and increased, and the people have in general been well disposed toward the matter; so much so that in 1897 a popular vote extended the application of the idea of "protection forests" to include not only the Alps, but also the Jura and some portions of the plateau region.

The remainder, the non-protection forests, were not under the supervision of the Confederation until 1917. The war caused the situation to be changed, and the Federal Council, exercising its full powers, decreed (February 23, 1917) that these forests should be provisionally regarded as protection forests, and subject to the laws governing such forests.

Forest Management.—Of the 1,682,000 acres of public forests in Switzerland, 1,537,300 acres, or 91.4 per cent, are covered with high forest (Hochwald, futaie). The high forest régime may be said to be applied to the great majority of the public forests of Switzerland, and methods of treatment range from clean felling to selection cutting, in all possible variations. Composite coppice covers about 59,000 acres, or 3.5 per cent of the total, and simple coppice 85,700 acres, or 5.1 per cent—a total area of 144,700 acres under coppice.

It is difficult to give accurate data on methods of management in private forests, for in many cases all systems are represented. There are certain advantages in the simple coppice which commend themselves to private owners. It is easy to handle and gives a constant annual yield with small outlay of capital. Moreover, most of the private forests of Switzerland are located on fairly level areas, suitable to this method. Hence it may be supposed that it is in more general use in private forests than other systems, although no reliable figures on this point are available.

The Forestry Movement.—The most influential association is the Schweizerischer Forstverein, organized in 1843. At the instigation of the Schweizerischer Forstverein a forestry department was added to the Federal Polytechnic School in 1855. The purpose of the forestry department is to furnish professionally trained men to manage the forests of the communes and cantons. Candidates for certificates from this institution are required to devote seven semesters to the study of theoretical forestry, in addition to one and one-half years of actual field work.

The Schweizerischer Forstverein also organized an investigation of the high mountain forests during the period from 1858 to 1862, and in 1874 succeeded in having inserted in the federal constitution a provision (Article 24) transferring to the Confederation the right of supervision of waters and forests. This supervision extended only to the forests of the higher mountains; but the federal forest law of March 24, 1876, based upon the new federal constitution, laid a broad foundation for the development of national and cantonal forest legislation.

In March, 1885, also through the initiative of the Schweizerischer Forstverein, a central forest experiment institute was established by federal law. The forestry exhibit at the National Exposition in 1883 had shown the great economic and protective importance of the forests, and had thus opened the way for the introduction of experimental work in forestry. The institute, founded in 1888, has abundantly fulfilled the expectations of its founders. It has rendered important service in laying a firm foundation for future work in forestry. Scientific research during the last 40 years has given a decided impetus to the forestry movement. The station has a large experimental garden, and all communal and cantonal forests are open for scientific experiment. There are also about one thousand experimental plots scattered throughout the cantons. The services of the station are available to private forest owners for advice and help in managing their forests.

The station publishes a report called "Mitteilungen der schweizerischen Zentralanstalt für das forstliche Versuchswesen." National forestry periodicals are the *"Schweizerische Zeitschrift für Forstwesen"* and the *"Journal Forestier Suisse,"* both published at Bern.

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CHAPTER III

THE FOREST SITUATION IN ASIA

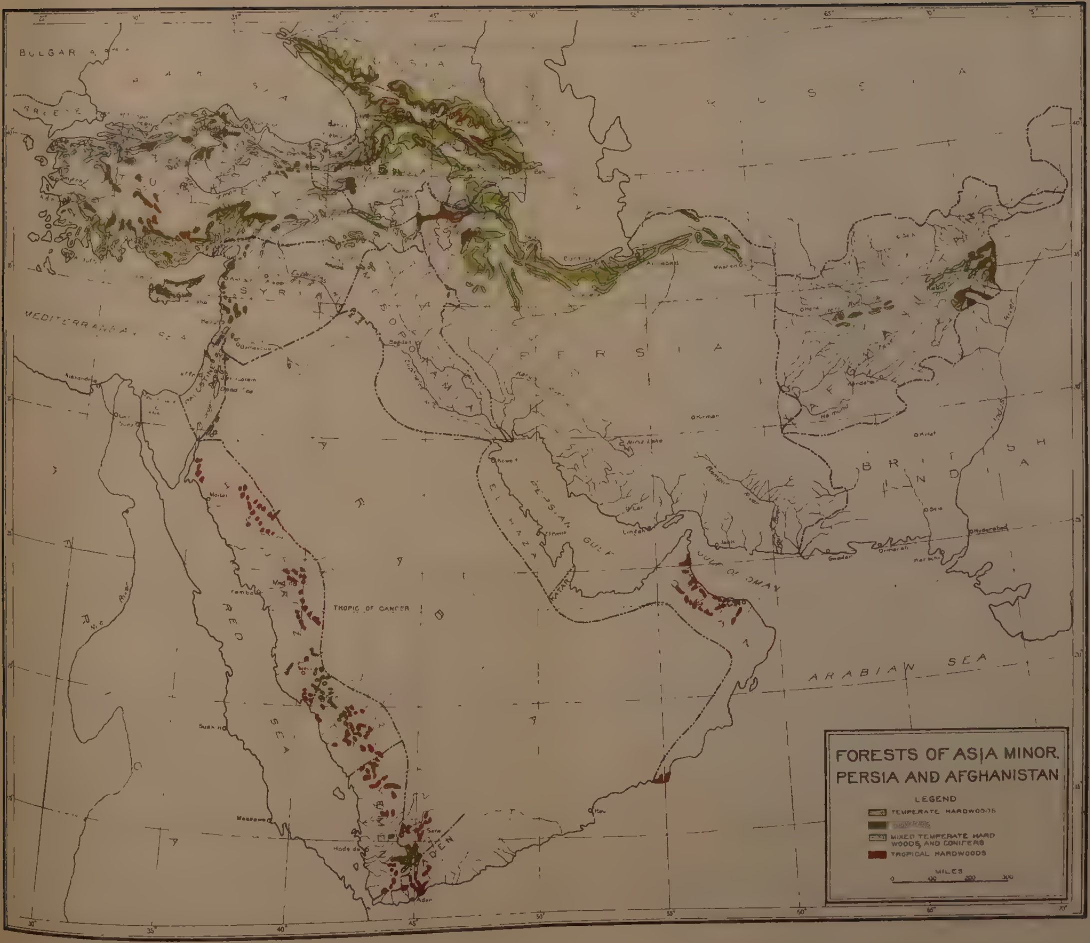
AFGHANISTAN

Forest Area.—The land area of Afghanistan is 157,000,000 acres. Afghanistan has been called the "country of stones and rocks." The largest part is mountainous, and the dominant mountain system is the Hindu Kush. Although the forests are unexplored, the land occupied by tree growth may probably be placed at about 1.5 per cent, or 2,352,000 acres. With a population of 6,380,500, this is 0.4 acre per inhabitant.

Character of the Forest.—The forests are confined to the mountains, chiefly Safed-Koh, which is an offshoot of Hindu Kush. Along the main range there is a coniferous belt extending from 6,000 to 10,000 feet in altitude. The conifers forming the principal forests are deodar (*Cedrus deodara*), fir (*Abies excelsa*), several pines (*Pinus longifolia, P. pinaster, P. pinea*), larch, and yew. Below the coniferous belt, at an elevation of less than 6,000 feet, there is a belt of hardwoods—walnut and oak mixed with alder, ash, juniper, and several other species. Still farther down, to 3,000 feet, are wild olive, acacia, mimosa, and jujube (*Zizyphus*). The conifers form about 30 per cent of the forest. Scattered over the plains of the Kandahar tablelands are leguminous thorny plants. Among the principal cultivated trees are walnut, myrtle, poplar, ash, and occasionally sycamore. On the whole the vegetation in the lowlands is similar to that of British India, and in the uplands it is like that of the temperate regions of Europe. One of the characteristic plants is *Narthex asafetida*, which occurs abundantly in the high and dry plains of western Afghanistan, especially between Kandahar and Herat. It yields a gum resin of asafetida which is exported to India. There are no trustworthy trade statistics for Afghanistan. The consumption can not be more than 5 cubic feet per inhabitant. There are practically no exports or imports of wood, therefore the annual cut must be about the same.

ARABIA

Arabia, including the Kingdom of Hedjaz, occupies an area of approximately 76,800,000 acres. For the most part it is a treeless country. Forest vegetation of any kind is found only in the Kingdom of Hedjaz and in the principalities of Yemen, Asir, and Oman. A great part, prob-


FORESTS OF ASIA MINOR, PERSIA AND AFGHANISTAN

ably one-half, of Arabia is still unexplored. From what is known, however, the forest vegetation may be placed at 1.5 per cent of the total land area, or about 1,150,000 acres. With a population of five million, this makes only 0.2 acre per person. Most of the hardwoods are tropical species such as fig, tamarind, and carob. Of the conifers, juniper is found on the higher slopes of Jebel Sabor near Taiz, forming an extensive forest and growing to a large size; it is also found in the range overlooking Wadi Madin, 50 miles west of Aden. Considerable forests are said to exist in Asir, and on the Tahama Range in Midian. Tamarisk is found everywhere in the broad sandy wadi beds. In cultivated uplands *Zizyphus jujuba* (jujube) grows to large sizes. It grows more slowly than tamarisk but yields better timber.

If the large amount of desert is excluded and the forest areas are considered by principalities, the forest resources of Hedjaz, Yemen, Asir, and Oman compare favorably with those of Syria and Palestine. The most heavily wooded province is probably Yemen, which includes fairly large stands of juniper, while Hedjaz comes next. By countries the land under forest may be estimated as follows:

TABLE 181.—FOREST AREA, ARABIA

Country	*Acres*
Yemen	450,000
Asir	200,000
Hedjaz	300,000
Oman	200,000
Total	1,150,000

Very little of this, however, is forest in the strict sense of the word. All the other principalities, Nejd and Hasa, Jebel Shammar, Aden, and Koweit, are practically treeless.

Yemen is a small province at the southwest corner of the Arabian peninsula. The strip near the coast is barren, with a few oases. Toward the east, at the edge of the tableland with local mountains exceeding 10,000 feet in height, there is greater rainfall and therefore a larger forest area. Conifers occur there.

The tree that could be grown to best advantage in Yemen is the white-flowered mimosa (*Acacia albida*). It does well in the highlands between 4,000 and 9,000 feet. Besides its value as firewood, it is a useful timber tree, supplying knees and ribs for boats. In the low land tamarisk is the most suitable tree. Jujube tree (*Zizyphus jujuba*) is also grown among the foothills up to 4,000 feet.

Asir, like the Kingdom of Hedjaz, has for an eastern boundary a rugged mountain belt with well-watered and fertile valleys. The slopes of the mountains are covered with forest and in the valleys are date palms and coffee trees, the products of which are known throughout the world for their quality.

Hedjaz lies between the highlands of the plateau of Arabia and the Red Sea coast. The name Hedjaz means barrier, and refers to the wall of high mountains on the edge of the tableland where most of the forests are found.

The wood consumption of Arabia is probably not over 5 cubic feet per inhabitant. Imports of wood are relatively small, and the annual cut is about the same as the consumption. Any increase in consumption will necessarily depend upon imports.

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BRITISH EAST INDIES—BORNEO

Forest Area.—North Borneo lies directly south of the Philippine Archipelago and at no great distance from the Islands of Mindanao and Palawan. The area of the State of North Borneo without Sarawak and Brunei is approximately 19,840,000 acres (31,000 square miles). The total forested area at present is estimated to be 19 million acres (96 per cent of land area). Of this probably 13 million acres carry commercial forest. With a population of some 258,000 (1921) this represents a forested area of 74 acres per capita. Because of the geographic proximity of North Borneo to the Philippines most of the important species are closely related to, or identical with, those of the Philippines. Some species, however, such as billian (*Eusideroxylon zwageri*) and Borneo camphor (*Dryobalanops* spp.), are found in abundance in Borneo, but only rarely or not at all in the Philippines. Recent explorations by the Forest Department of British North Borneo have shown that there are vast forest areas of excellent timber easy of access from the sea and suitable for modern steam methods of logging.

Sarawak has a land area of 26,880,000 acres, of which 80 per cent, or 21,500,000 acres, are probably wooded. With a population of 600,000 this makes 35.8 acres per inhabitant. Although timber in Sarawak is one of the most valuable products, little is exported except billian from the River Rejang. The most important timbers are billian, medang (several trees of the *Lauraceae* family), meranti (several species of *Shorea*, with soft wood), and kapor, or Borneo camphor (*Dryoba-*

lanops spp.). Except near the banks of the rivers which have been cleared by the natives for farming purposes, the whole of Sarawak is thickly clothed with timber.

The total forest area of British Borneo is in the neighborhood of 40,500,000 acres. This is 82 per cent of the total land area and 45.5 acres per inhabitant. (Table 182.)

TABLE 182.—FOREST AREA, BORNEO

State	Land area	Forest area	Per cent	Population	Per capita
	acres	*acres*			*acres*
North Borneo	19,840,000	19,000,000	96	258,000	73.6
Brunei	2,560,000	....	......	32,000	......
Sarawak	26,880,000	21,504,000	80	600,000	35.8
Total	49,280,000	40,504,000	82	890,000	45.5

Character of the Forest.—The character of the forests of the interior is as yet unknown. The forests of the northern and eastern coasts contain the most valuable stands of timber. Lowland forests close to the banks of tidal rivers do not, as a rule, contain as heavy stands as are found farther inland on rising land where the drainage is better. The finest forests are found on the mountain slopes and on rolling land between the central mountain ranges and the sea. There is an extensive dense forest following the coast line for 150 miles in the southeastern part of British North Borneo and a smaller forest belt exists along the northeastern coast. The average stand per acre may run as high as 2,000 cubic feet. The close relation of Bornean forests to those of the Philippines is shown in Table 183, which gives the average stand per acre and percentages for the important species of Borneo and for identical, or closely related, species in the Philippines. This average is based on actual measurements of 5,420 acres in Borneo and 4,365 acres in the Philippines.

It is noteworthy that the five species of the dipterocarp family, which occur in quantity in both countries, make up 66.2 per cent of the stand in Borneo and 63.3 per cent of the stand in the Philippines. Of these five trees all except selangan batu (Philippine yacal) have relatively soft wood. Tanguile (*Shorea polysperma*) occurs in the Philippines in much greater abundance than in Borneo, while kapor (*Dryobalanops* spp.) is not represented in the Philippines. Both of these are also "softwoods," but not in the sense in which the term is used in trade, applying to pine, spruce, larch, and other conifers. The commercial woods of North Borneo are "hardwoods" in the sense recognized by the trade in temperate regions. Although the number of species represented in the forests of Borneo is very great, the number which occur in sufficient quantity to be of commercial use is relatively small. The dipterocarp family furnishes much the largest part of the commercial timber of Borneo. Seven of the ten most abundant commercial woods, and 60 per cent of the volume of trees over 16 inches in diameter belong to this group.

Exports and Imports.—The export trade in Borneo timber reached its maximum in 1913, when 1,565,989 cubic feet of logs and 162,150 cubic feet of sawn lumber were exported, valued locally at $480,654. Since 1913 the export trade has fallen off, owing largely to lack of tonnage, but there is every prospect of decided increase in the exports. In the past over 90 per cent of all shipments have gone to Hongkong, and 62 per cent of shipments of sawn timber have gone to either Singapore or London. Borneo timber practically dominates the Hongkong market, and as Hongkong has been able to absorb the greater part of the output there has been little attempt to place the timber elsewhere. (Table 184.)

Lumber Industry.—Although logging operations have been carried on in North Borneo for 35 years, a relatively small area of timberland has been cut over. Steam logging was introduced only recently. As a rule, an area is abandoned when the timber within two or three miles of the river has been cut. The logs are generally loaded off directly into the water, bound into rafts of 4 to 6, and floated and poled with the out-

Table 183.—Composition of Forests in Borneo and Philippines

Species	Stand per acre in Borneo	Per cent	Stand per acre in Philippines	Per cent
	cu. ft.		*cu. ft.*	
Seriah (*Shorea* spp.)	554	30.7	490	20.5
Kruin (*Dipterocarpus* spp.)	265	14.7	471	19.7
Urat mata (*Parashorea* spp.)	189	10.5	413	17.3
Selangan batu (*Shorea, Hopea,* and *Isoptera* spp.)	114	6.3	73	3.0
Kapor (*Dryobalanops* spp.)	109	6.0	Not represented	
Selangan kacha (*Shorea* spp.)	72	4.0	66	2.8
Billian (*Eusideroxylon swageri*)	72	4.0	Not represented	......
Mengaris (*Koompassia excelsa*)	70	3.9	rare	......
Identified species of commercial value not occurring in large quantities	158	8.8	446	18.7
Unidentified and miscellaneous species	200	11.1	430	18.0
Total	1,803	......	2,389	......

TABLE 184.—EXPORTS OF TIMBER FROM BRITISH NORTH BORNEO

Name of wood	1915			1914			1913			1912			Total
	Logs	Sawn	Order	Logs	Sawn	Order	Logs	Sawn	Order	Logs	Sawn	Order	
	cu. ft.	*cu. ft.*		*cu. ft.*	*cu. ft.*		*cu. ft.*	*cu. ft.*		*cu. ft.*	*cu. ft.*		*cu. ft.*
Seriah (seraya) (*Shorea* spp.)	39,253.4	45,923.11	5	315,546.00	77,007.70	1	380,624.40	96,488.00	1	354,672.5	97,488.0	1	1,407,003.11
Billian (*Eusideroxylon zwageri*)	431,839.1	907.30	1	351,694.30	190.11	2	314,938.40	202.90	4	285,532.1	329.5	2	1,385,633.71
Kapor (*Dryobalanops* spp.)	330,189.2	68,902.30	2	268,279.30	64,173.80	3	274,881.00	47,324.11	2	233,248.6	39,770.8	3	1,326,769.11
Kruin (*Dipterocarpus* spp.)	360,882.2	....	3	314,219.91	418.70	4	315,031.20	207.11	3	153,498.5	6,414.8	4	1,150,672.42
Selangan Batu (*Shorea, Hopea,* and *Isoptera* spp.)	164,329.0	92.70	4	139,893.31	4,056.10	5	153,177.41	7,555.90	5	142,668.5	15,609.1	5	627,382.02
Guijo[1]	23,309.0	....	8	44,200.40	....	6	52,277.00	....	6	45,460.6	....	6	165,247.00
Mirabau (Merbau) (*Intsia* spp.)	30,385.6	4,897.80	7	27,091.20	8,089.11	7	13,292.90	8,729.50	7	8,411.3	8,809.3	7	109,706.71
Selangan kacha (*Shorea* spp.)	55,860.0	....	6	16,304.00	23.60	8	17,724.00	....	8	3,972.0	....	12	93,883.60
Oba Sulu (*Shorea* spp.)	6,062.0	1,039.40	9	4,654.00	....	11	9,587 20	1,642.50	10	9,223.2	4,504.6	8	36,712.90
Griting	15.0	....	16	5,895.91	....	10	16,333.80	....	9	8,616.0	4,504.6	10	35,365.31
Rasak Batu (*Vatica* spp.)	5,962.1	....	10	4,272.51	131.00	12	6,095.00	....	11	13,454.6	....	9	29,915.21
Gagil (*Shorea* sp.)	3,440.0	....	11	6,376.00	....	9	5,359.50	....	12	3,059.0	....	13	18,234.50
Keranji (*Dialium* spp.)	3,109.5	....	13	3,613.10	....	14	2,097.90	....	14	3,993.0	....	11	12,813.50
Narra[2]	2,390.0	....	14	4,245.90	....	13	1,100.40	....	15	2,372.0	....	14	10,108.30
Kamuning	3,149.5	....	12	2,336.50	....	15	2,800.70	....	13	1,771.0	....	15	10,057.70
Mengaris (*Koompassia excelsa*)	993.0	....	15	910.00	....	16	578.00	....	16	1,255.0	....	16	3,736.00
Total	1,461,168.6	121,762.61	.....	1,509,532.34	154,090.12	.....	1,565,898.81	162,150.02	.....	1,271,207.9	177,430.7		Logs 5,807,807.65 Sawn 615,433.45
Total British North Borneo	1,582,931.21			1,663,622.46			1,728,048.83			1,448,638.6			

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[1] Guijo is Selangan Batu Merah.

[2] Narra is Miamot.

going tide to lighters farther down the river. As 50 per cent of freshly cut Borneo timber sinks, it is necessary to provide floaters for the heavier species.

Minor Forest Products.—The aggregate value of the minor forest products often exceeds that of the timber produced by the forest. The principal minor products in British North Borneo are: firewood, rattan, palms (other than rattans), gums, oils, rubber, gutta-percha, tanbarks, dyestuffs, fibers, incense woods, fruits and other food from the jungle, and medicinal and poisonous plants. They are usually collected by natives and sold to small Chinese traders. Where these products are collected from the public forests for sale, it is usually considered that a revenue tax of 10 per cent of the market value is fair. In the early days of the state minor products made up nearly 50 per cent of the total value of the exports. As commerce developed, the minor forest products became relatively less important. In 1915 the combined value of the timber and minor forest products was only 20 per cent of the total value of the exports. For a period of 31 years from 1885 to 1915, inclusive, minor forest products made up about 15 per cent of the total exports.

The Probable Future.—The investigations made by foresters in the Philippines and other tropical countries show that the tropics are becoming more and more a source of hardwoods for the world markets. Some tropical regions will become practically independent of foreign supplies and will furnish their next-door neighbors with all the timber they need. This is becoming true of the Malay and Philippine archipelagoes. The resources are abundant, and with some care can be made inexhaustible. A start in utilization has been made in both the Philippines and Borneo, which place their "ordinary timbers" in outside markets. British North Borneo has been exporting construction timbers as well as the rare hardwoods ever since 1881, and just prior to the war was successfully placing the softer but well-colored woods on markets in the United Kingdom and Australia. In 1913 the Government of British North Borneo decided that forest resources were an asset which merited attention, and early in 1915 a definite program of forest exploration was inaugurated. By the end of that year the work had proceeded far enough to indicate that the timber of the state was one of its principal assets, and in 1916 the Forestry Department was definitely organized as a permanent government institution and the work of exploration and development begun.

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CEYLON

Forest Area.—Ceylon lies entirely in the tropics, between 10° and 6° north. The length of the island is 270 miles from north to south, and its breadth is 140 miles. It is about 16,320,000 acres (25,500 square miles) in extent. The area covered by accessible merchantable forest is about 2,880,000 acres (4,500 square miles). This is merely an estimate, as no accurate figures are available. If the total forest area is considered, 80 per cent of the island is under forest. If, however, the actual workable forest area is considered, then only 10 to 12½ per cent of the total land area must be regarded as under forest. The classification of land area is given below:

Table 185.—Classification of Land Area, Ceylon

Class	Acres	Percentage of total area
Agricultural land	3,116,160	19
Forests:		
Merchantable	3,082,240	19
Unprofitable or inaccessible	9,948,800	61
Total forest land	13,031,040	80
Other land	160,640	1
Grand total	16,307,840	100

Character of the Forest.—There are between 500 and 600 different kinds of timber trees on the island. Although the forest flora is very similar to that of British India, it contains a number of species peculiar to Ceylon. Three zones or types of forest are distinguished:

1. The mountain zone
2. The wet zone
3. The dry zone

1. The *mountain zone* is that part of the island which is more than 4,000 feet above sea level. It comprises the south central table land, an area of some 2,560,000 acres (4,000 square miles). The rainfall in this

zone varies from 75 to 200 inches a year. The forests above 5,000 feet have been reserved and no alienation of land is allowed. As a result of this regulation, which has been in force since 1874, there are reserved at present about 83,200 acres (130 square miles) of forest land within this type of forest. This is the zone in which the cultivation of tea and coffee has been greatly developed. Much clearing has been done for tea and coffee plantations and most of the best and largest tea plantations are in this zone. The value of these mountain forests is chiefly for water supply and prevention of erosion. As a rule the trees are short, crooked, and gnarled from continual winds and rainfall. Conifers, eucalypts, and Australian wattles have been planted to a large extent within the zone, and now they form in some places a characteristic feature of the forest. The most successful of these introduced trees are:

Cupressus macrocarpa, C. knightiana, and *C. torulosa.*

Pinus insignis and *P. longifolia* in Nuwara Eliya.

Eucalyptus robusta, E. globulus, E. pilularis, E. siderophloia, and *E. diversicolor.*

Acacia melanoxylon, A. decurrens, and *A. dealbata.*

In the west and southwest of the island the mountain type of forest gradually merges into the wet type, and in the north, east, and southeast, it merges abruptly into the dry type of forest.

2. The *wet zone* occupies the southwestern portion of the island and all of the foothills up to about 4,000 feet. This type of forest corresponds to the area of heaviest rainfall, 100 to 200 inches and over a year. The finest forests of the island are included in this zone. It contains many species of trees which are peculiar to Ceylon and more closely resemble those of Malaysia than of India. Because of the large number of species of dipterocarps, this zone is often called the dipterocarp zone. The dipterocarps are represented by such genera as *Dipterocarpus, Doona, Shorea, Hopea, Balanocarpus, Vatica,* and *Vateria,* all as a rule large and valuable timber trees. Great inroads have been made into this type of forest by clearing for rubber, tea, cinnamon, and other plantations. As a result large areas of virgin forests have been cleared, and erosion on an immense scale has taken place with subsequent silting and flooding of the low-lying country and destruction of arable lands and other property. Vast areas of once valuable virgin forest land are now covered with bamboos, valueless scrub, or rank and useless grasses.

3. The *dry zone* includes two-thirds of the island and nine-tenths of its forest area. It is divided into three sub-zones, namely, the arid zone, the dry zone proper, and the park country. The trees are of little commercial value, seldom reaching more than 30 to 40 feet in height. The forests contain only about 2 per cent of species that may be classed as valuable trees, although in a few parts the number of valuable species

may be as high as 12 or even 15 per cent. Much of this area has been still further reduced in value by fires and grazing.

Character of Ownership.—The character of ownership of the forests of the island is given in Table 186.

TABLE 186.—CLASSIFICATION OF THE FOREST AREA BY OWNERSHIP—CEYLON

Ownership	Acres	Percentage of total area
Area belonging to:		
The state:		
Dedicated to timber production	2,698,240	20.7
Other forest	7,231,360	55.5
Total	9,929,600	76.2
Corporate bodies	2,996,480	23.0
Private individuals	104,960	0.8
Total forest area	13,031,040	100.0

As may be seen from the table, more than three-fourths of the total forest and waste land area is in state ownership, the remainder being owned chiefly by various religious bodies. The area in private ownership is practically negligible. There are some 5,120 acres of plantations, chiefly of teak in the low country, and of eucalypts, Australian black wattle, and a few conifers above 4,000 feet.

Annual Growth.—The gross and net annual growth are given in Table 187. Most of the forest growth is in the less accessible forest.

Annual Cut.—The annual cut for an average of 10 years amounted to 15,630,038 cubic feet, distributed as follows:

	Type of product	*Quantity*
Crown forests	(a) Ebony in log	3,638 cubic feet
	(b) Satinwood in log	4,860 cubic feet
	(c) Other timbers	822,570 cubic feet
	Firewood	14,798,970 cubic feet
	Minor products, etc.	....
Other forest lands	All products	No accurate figures available.

The cut is entirely for home consumption except in the case of high-grade logs of satinwood and ebony which are sold at the Central Timber Depot, Colombo, to various timber dealers for export.

TABLE 187.—GROSS AND NET ANNUAL TIMBER GROWTH OF CEYLON

Class of forest	Area	Growth			Loss			Net growth
		Product	Per acre	Total	Fire	Decay and waste	Total	
	acres		*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Forests under state control	2,560,000	Timber	3.2	8,239,000	2,000	7,624,890	7,626,890	612,110
		Fuel	590.8	1,512,511,380	135,000	1,487,079,810	1,487,214,810	25,296,570
Other forests	640,000	(Not used	in aver	age increment)	(Includ	ed in above figur	es)	
Total	3,200,000	Timber	2.6	8,239,000	2,000	7,624,890	7,626,890	612,110
		Fuel	472.7	1,512,511,380	135,000	1,487,079,810	1,487,214,810	25,296,570

Exports and Imports.—A summarized statement of the exports and imports is given in Table 188. They are the average for the 10 years 1910–1920.

Table 188.—Average Annual Exports and Imports, Ceylon

Kind of timber	Exports		Imports		Difference + =Exports − =Imports
	Cu. ft.	Value	Cu. ft.	Value	
Round and square timber	50,170	$43,957	366,642	$229,920	$−185,963
Sawn timber	386,710	13,782	175,620	7,559	+ 6,223
Other timbers		24,600		19,800	+ 4,800
Total	436,880	$82,339	542,262	$257,279	$−174,940

This table of imports and exports refers to timber alone. The gross value of imports of wooden manufactures amounts to $1,045,451, while the gross value of exports of wooden manufactures is $758,032, making the net value of imports $287,419.

The timber imported is principally in the form of tea and rubber chests, most of which come from Japan.

Domestic Consumption.—Deducting from the annual cut the amount exported, 436,880 cubic feet, and adding the amount imported, 542,262 cubic feet, the amount actually consumed by the population of Ceylon must be in the neighborhood of 15,735,420 cubic feet, or 3.4 cubic feet per capita.

Forest Industries.—The largest forest industry is the manufacture of tea and rubber chests, 360,000 cubic feet of material being utilized annually in this industry. The total number of people employed, including dependents, is 94,900, and the actual number of workers is some 70,000, almost all on part-time employment. Little machinery is used in the industry, the sawing being done by hand; it is largely in the nature of a village industry.

Basket making and cane weaving employ a large number of people. About 5,500 are employed in furniture making, cooperage, boat building, and similar trades. The collection of minor forest products generally employs 1,000 people.

The Probable Future.—The forest situation in Ceylon is summarized in Table 189.

It would seem that while the forests of Ceylon can probably furnish the island with fuel in perpetuity, the supply of saw-timber is

TABLE 189.—FOREST SITUATION, CEYLON

Type of product	Production	Exports	Home consumption of home-grown timber	Imports	Total home consumption of homegrown and imported timber	Net growth	Balance + or −
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Timber (in log and sawn)........	831,068	436,880	394,188	542,262	936,450	612,110	−324,340
Firewood........................	14,798,970	....	14,798,970	....	14,798,970	25,296,570	+10,497,600

rapidly diminishing. It has been estimated that the supply of hardwood saw-timber may possibly last for another 10 years. The most critical situation, however, is regarding the softwoods, upon which the trade of the country entirely depends. If the supply of softwoods from abroad were suddenly cut off Ceylon might not have enough timber to satisfy the internal demand for more than six months. The situation is even worse in view of the fact that the forest capital is reduced annually by 160,493 cubic feet of fine merchantable timber from sales of land for the cultivation of various commercial products. Even with proper forest management it will be a long time before Ceylon can produce enough timber to meet its own needs, particularly of softwoods.

The Forestry Movement.—Forest legislation in Ceylon is of very recent date. The forests were put under the control of a forest department in 1905, by a law which declared all forest, waste, uncultivated, or unoccupied lands to belong to the state. It established regulations for the protection of all government lands, for the declaration of reserves, for village forests, for the control of both crown and private timber in transport, and for the checking and punishment of forest offenses. The law still lacks powers over privately owned lands. The forest department of Ceylon urges as one of the necessary measures for forest production, the granting of power to the state over private owners whose irresponsibility and short-sighted action may endanger public interests. The revenues and expenditures of the forest department for the years 1911–1919 are shown in Table 190.

TABLE 190.—FOREST REVENUES, CEYLON

Year	Revenue	Expenditures	Surplus	Net revenue per acre[1]
1910–11[2]	$ 563,099	$129,106	$ 433,993	$0.16
1912–13[3]	336,063	102,565	233,498	0.09
1914–15	182,746	93,714	89,032	0.03
1915–16	195,926	100,572	95,354	0.04
1916–17	316,521	112,027	204,494	0.08
1917–18	391,591	123,208	268,383	0.10
1918–19	401,193	142,812	258,381	0.10
Total	$2,387,139	$804,004	$1,583,135	....
Average	341,020	114,858	226,162	0.08

[1] Based on 2,698,240 acres.

[2] Eighteen months' period.

[3] Fifteen months' period.

Principal Forest Trees.—The most valuable timber trees or the most common trees, although not of any particular value at present, occurring in the forests of Ceylon, are summarized in the table below:

TABLE 191.—THE MOST IMPORTANT TREES OF CEYLON

Either because of their commercial value or common occurrence.

English and native names	Scientific name	Properties of wood	Uses
		Guttiferæ	
1. Hill Kina; Sinhalese, Kina.	Calophyllum walkeri, Wight.	Light or dark reddish brown, hard, durable, easily worked.	Carpentry, bridge timbers, etc.
2. Ironwood; Sinhalese, Na; Tamil, Naka.	Messua terrea, Linn.	Dark red, heavy, hard, durable, difficult to work.	Bridge timbers, ties.
3. Sinhalese, Mihiriya	Gordonia zeylanica, Wight.	Reddish, hard, durable.	Flooring, ceiling boards, weather boards.
4. Sinhalese, Hora	Dipterocarpus zeylanicus, Thw.	Very large tree, wood brownish red, fairly hard but not resistant to weather.	Boats, casks, beams, etc.
5. Shingle tree; Sinhalese, Dun.	Doona zeylanica, Thw.	Very large tree, wood brown, hard, durable.	Railroad ties, beams, bridge timbers, shingles.
6. Sinhalese, Yakahalu	Doona trapezifolia, Thw.	Large, wood dark, close-grained, hard, durable.	Carpentry, beams, planks.
7. Sinhalese, Dun; Tamil, Tumpalai.	Vatica obscura, Trim.	Large tree; wood hard, heavy, dark brown.	Building, railroad ties, telegraph posts.
		Sterculiaceæ	
8. Sinhalese, Velang; Tamil, Vinanku, Miyanku.	Petrospermum suberifolium, Lam.	Fairly large, wood gray-brown, medium hard. Easily worked, light, strong, pliable.	Much used in ancient times; no longer in demand. Suitable for building, posts, carts, spokes, etc.
		Tiliaceæ	
9. Sinhalese, Halmilla; Tamil, Chavandalai.	Berrya ammonilla, Roxb.	Large; wood usually yellowish brown; hard, close-grained, very durable, elastic.	Gun carriages, boats, casks, furniture, building.

TABLE 191.—THE MOST IMPORTANT TREES OF CEYLON—*Continued*

English and native names	Scientific name	Properties of wood	Uses
Meliaceæ			
10. Sinhalese, Lunumidella; Tamil, Malai Vempu.	Melia dubia, Thw.	Large; very fast-growing; deciduous. Wood soft, gray, red-white or red-brown, similar to cedar. Not resistant to weather; easily worked. As an aeroplane timber it is a suitable substitute for Sitka spruce; in general it may be used as a substitute for coniferous timber. It reaches utilizable maturity in 20 to 25 years.	Tea-boxes, casks, ceilings, carts, and planking.
11. Margosa tree; Sinhalese, Kohomba. Tamil, Vempu.	Azadirachta indica, A. Juss.	Large tree. Wood hard, close-grained, red or red-brown, takes polish well; very durable, ant-proof.	Cabinet and furniture making, cart and shipbuilding.
12. Satinwood; Sinhalese, Buruta; Tamil, Mutirai.	Chloroxylon swietenia, D. C.	Large, slow-growing, semi-deciduous. Wood very hard, yellow, fine lustre. Durable, ant-proof, and teredo-proof. Ceylon's most valuable timber.	Ties, cabinet-making, furniture, building, veneer, frames; water pipes.
13. Chittagang wood; Sinhalese, Hulanhik; Tamil, Aglai or Kaloti.	Chickrassia tabularis, A. Juss.	Very large, grows fairly fast; wood hard, red-brown, satiny lustre, close-grained, duraable, works well. Little known, hence not much used.	Furniture, ties, bridge timbers, building.
Celastrineæ			
14. Sinhalese, Panaka; Tamil, Piyari.	Pleurostylia wightii, W. & A.	Small tree, wood light red, orange or yellowish brown; hard, close-grained, takes polish well.	Ties, building, furniture, carts, etc.
15. Sinhalese, Neralu; Tamil, Perum-piyari.	Elaeodendron glaucum, Pers.	Small; wood hard, even-grained, light brown, reddish brown, or streaked brown and pale red.	Cabinet work, furniture, etc.
Sapindaceæ			
16. Sinhalese, Kon; Tamil, Kula; Ceylon oak.	Schleichera trijuga, Willd.	Large, semi-deciduous. Wood hard, very strong, fairly durable.	Houses, furniture, agricultural implements.

Table 191.—The Most Important Trees of Ceylon—*Continued*

English and native names	Scientific name	Properties of wood	Uses
		Leguminosæ	
17. Sinhalese, Gammalu; Tamil, Venkai.	Pterocarpus marsupium, Roxb.	Large, semi-deciduous. Wood yellowish brown, resembles teak. Durable, hard, close-grained. Polishes well.	Furniture, paneling, carpentry, carts, ties.
18. Sinhalese, Nedun....	Pericopsis mooniana, Thw.	Very large tree, fairly fast-growing. Wood pale brown or dark brown, streaked. Polishes well, very handsome. Durable, strong. Now rare.	High-grade furniture only.
19. Sinhalese, Wa; Tamil, Vakai.	Cassia siamea, Lank.	Sapwood light, heart darker, wavy grain. Hard, durable, handsome, takes fine polish.	Paneling, furniture, inlaying, agricultural implements, fuel.
20. Sinh., Mara; Tamil, Vakai.	Albizzia lebbek, Benth.	Large, semi-deciduous. Wood yellow and dark brown, variegated. Hard, fairly durable.	Houses, carts, and furniture.
21. Ceylon Rosewood; Sinhalese, Suriya Mara; Tamil, Ponnaimurankai.	Albizzia odoratissima, Benth.	Very large, fairly fast-growing. Wood hard, white and red or red-brown variegated. Polishes and seasons well. Handsome.	Furniture, carriages, cabinet making.
22. Sinh., Hulan-mara; Tamil, Katturankai.	Albizzia stipulata, Boivin.	Small or medium sized, fast-growing, deciduous. Wood reddish-brown, hard, polishes well.	Furniture, cabinet making, carts.
		Rhizophoraceæ (Mangroves)	
23. Sinh., Ubberiya.....	Carallia calcynia, Thw.	Very large tree, fast-growing. Wood dark red, hard, durable, with silvery yellow cross-grain.	Paneling, cabinet making.
24. Sinh. Dawata; Tamil, Karalli.	Carallia integerrima, D. C.	Large, aerial roots. Wood hard, red, fairly durable.	Same as above.
25. Sinh., Welipenna....	Anisophyllea zeylanica, Benth.	Medium-sized; wood brittle, splits easily, gray-red color. Not very durable.	Paneling, shingles and building.
		Combretaceæ	
26. Sinh., Kumbuk; Tamil, Marutu.	Terminalia glabra, W. & A.	Large, handsome tree. Wood white and brown; hard, durable, strong.	Bridge timbers, furniture, houses, canoes.
27. Sinh., Aralu; Tamil, Kadukkai; Gallnut or Inknut trees.	Terminalia chebula, Retz.	Small, deciduous. Wood very hard, durable, takes good polish.	Furniture, houses.

TABLE 191.—THE MOST IMPORTANT TREES OF CEYLON—*Continued*

Myrtaceæ

English and native names	Scientific name	Properties of wood	Uses
28. Sinh., Mahadan, Madan, Maha Damba; Tamil, Naval.	Eugenia jambolana, Lam.	Very large; wood yellowish or reddish gray; hard, fairly durable, especially under water. Works well.	Carts, boats, bridge timbers, ties, beams.
29. Sinh., Damba; Tamil, Nir Naval.	Eugenia gardneri, Duth.	Fairly large, grows slowly. Wood dark brown, fairly heavy, hard. Much in demand.	Houses, bridge timbers, ties.
30. Sinh., Alubo........	Eugenia sylvestris, Wight.	Large, fast-growing. Wood gray-white, fairly hard, tough, not very durable.	Boxes, ceilings, rafters, any inside building.

Rubiaceæ

English and native names	Scientific name	Properties of wood	Uses
31. Sinh., Kolon; Tamil, Manchal-Kadampa.	Adina cordifolia, Hook.	Very fast-growing, deciduous. Wood yellow, resembles satinwood. Hard, durable, polishes well. Lasts over 50 years if protected from rain.	Cigar boxes, oil barrels, turning, furniture, building.

Sapotaceæ

English and native names	Scientific name	Properties of wood	Uses
32. Sinh., Mi; Tamil Iluppai.	Bassia longifolia, Willd.	Very large tree; wood dull red, durable, hard, lasts well under water.	Ties, beams, houses, bridges, heavy work of all kinds.
33. Sinh. Munamal; Tamil, Mukalai, Mukil.	Mimusops elengi, Linn.	Large tree, wood reddish brown and dark brown, close-grained, very hard.	Railway ties, furniture, agricultural implements, carts, bridges and houses.
34. Sinh. Palu; Tamil, Palai,	Mimusops hexandra, Roxb.	Wood dark and purplish red, very hard, tough, even-grained, durable, takes fine polish, resistant to ants. Very useful.	Work requiring durability and strength. Ties, bridges, furniture.

TABLE 191.—THE MOST IMPORTANT TREES OF CEYLON—*Continued*

Ebenaceæ

English and native names	Scientific name	Properties of wood	Uses
35. Sinh. Kaluwara; Tamil, Karunkali; Ebony.	Diospyros ebenum, Koenig.	Large, slow-growing tree. Wood very hard, smooth, even-grained. Very durable, polishes beautifully. Color, sapwood yellow with black streaks, heart jet black.	Furniture, piano keys, cabinet work, inlaying.
36. Sinh., Hompenella; Tamil, Velai; Karunkali; Ebony.	Diospyros oocarpa, Thw.	Moderate size, wood hard, durable, takes fine polish. Sapwood yellowish, heart banded jet black and golden yellow. Must be thoroughly seasoned for years.	Cabinet work, furniture, etc.
37. Sinh., Kadumberiya; Tamil, Velai; Karunkali.	Diospyros quaesita, Thw.	Wood yellow streaked with black. Of little value.	Used occasionally for furniture, walking sticks, house building.
38. Calamander tree; Sinh. Kalumediriya.	Diospyros quaesita, Thw.	Tree now very rare. Wood most beautiful of ebonies, bands of gray, yellow, and black. Hard, durable.	Furniture and cabinet work.
Verbenaceæ			
39. Sinh., Milla; Tamil, Kadamanakku.	Vitex altissima, Linn.	Wood mixed yellowish brown, grayish yellow, olive brown. Hard, close-grained, tough, very durable. Polishes well.	Railway ties, bridges, houses, carts, door frames, shingles, casks.
Lauraceæ			
40. Sinh. Wewarani; Tamil, Ranai, Yawaranai.	Alseodaphne semecarpifolia, Nees.	Very large, grows fairly fast. Wood hard, straight-grained, very strong and durable. Excellent timber.	Building, furniture, railway ties, bridges.
41. Sinh. Kududawula, Dawulkurundu.	Litsea zeylanica, Nees.	Wood handsome, polishes well, even-grained, fairly hard. Good all-round wood, too little known.	Furniture, boxes, paneling, ceiling boards.
Euphorbiaceæ			
42. Sinh. Wira; Tamil, Virai.	Hemicyclia sepiaria, W. and A.	Small tree, wood pale yellow or white, resembles boxwood. Hard, close-grained, tough, fairly durable.	Sometimes used for building, wheel spokes, handles. Good fuel wood.

TABLE 191.—THE MOST IMPORTANT TREES OF CEYLON—*Continued*

Urticaceæ

English and native names	Scientific name	Properties of wood	Uses
43. Sinh., Kos; Tamil, Pila; Jak tree.	Artocarpus integrifolia, Linn.	Wood bright yellow, turning dark with age. Hard, heavy, strong, durable, close-grained. Takes fine polish. Very valuable, often sold as mahogany.	Cabinet making, furniture, houses, ties bridges, boats.

Palmeæ

44. Palmyra palm; Sinh., Tal; Tamil, Panai.	Borassus flabelliformis, Linn.	Large palm; wood dark brown, very hard, fairly durable. Center soft.	Furniture, rafters, posts, cart poles, gutters, water pipes.
45. Coconut palm; Sinh. Pol; Tamil, Tenne.	Cocos nucifera, Linn.	Tall palm, wood resembles palmyra, hard.	Building, furniture, carts, ornamental carving.
46. Toddy palm; Sinh., Kitul; Tamil, Tippilipanai.	Caryota urens, Linn.		Uses same as palmyra.

Cramineæ

47. Sinh., Una, Katauna, Unali; Tamil, Mungil.	Bambusa arundinacea, Schrad.	Large bamboo; often 100 feet high.	Fencing, water pipes, etc.
48. Sinh., Bata-li; Tamil, Sinna Mungil.	Ochlandra stridulata, Thw.	Common small bamboo.	Fencing, thatching.

Common Exotic Timber Trees

Tectona grandis, teak.
Swietenia macrophylla, Honduras mahogany, and S. mahagoni, West Indian mahogany.
Cedrela serrata, Cedarwood.
Eucalypts: E. robusta, E. globulus, E. pilularis, E. siderophylla, E. maculata, E. alba.
Acacia melanoxylon (Blackwood).
Myroxylon pereiræ, Peru balsam.
Cupressus macrocarpa.
Cupressus knightiana, C. torulosa, C. lawsoniana, Pinus longifolia, and P. insignis. Sequoia sempervirens, Araucarias, Callitris rhomboidea (Cypress pine), and Cryptomeria japonica.

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CHINA

Forest Area.—The Chinese territory comprises China proper (21 provinces), Mongolia, eastern Turkestan (known also as the New Territory or Sinkiang), and Tibet. The total land area of Chinese territory is estimated at about 2,740,000,000 acres, apportioned among the different regions as shown in Table 192.

Table 192.—Land Area, China

Region	Area	
	acres	*sq. miles*
China proper	980,992,000	1,532,800
Manchuria	232,768,000	363,700
Mongolia	875,489,920	1,367,953
Chinese Turkestan	352,370,560	550,579
Tibet	296,524,800	463,320
Total	2,738,145,280	4,278,352

The population of China has been estimated at 331 million. The forest area is estimated at between 190 and 200 million acres, or 6.9 per cent of the total land area. The per capita forest area for the entire Chinese territory is therefore 0.6 acre.

The forests are distributed among the different provinces and territories of China as shown in Table 193.

Table 193.—Forest Distribution, China

Northern Provinces

Province	Forest area	Forest per capita	Per cent forested	Most valuable tree species
	acres	*acres*		
Kansu	6,000,000	0.60	7.5	Spruce, pine, fir, birch, poplar.
Shensi	5,200,000	0.60	10.8	Pine, fir, spruce, hemlock, hardwoods.
Shansi	2,800,000	0.20	5.3	Pine, spruce, larch.
Honan [1]	....	....	....	....
Chihli	300,000	0.02	0.4	Oak, poplar, walnut, birch, elm, pine.
Shantung [1]	....	....	....	....

TABLE 193.—FOREST DISTRIBUTION, CHINA—*Continued*

Central Provinces

Province	Forest area	Forest per capita	Per cent forested	Most valuable tree species
	acres	*acres*		
Szechwan........	35,000,000	0.60	29.1	Laurel, cryptomeria, maple, oak, chestnut, spruce, fir, pine, birch, poplar, beech, larch, arborvitae.
Hupeh..........	7,000,000	0.20	15.4	Ash, beech, birch, chestnut, laurel, oak, pine, spruce, fir, hemlock.
Hunan..........	11,000,000	0.50	20.7	....
Kiangsi.........	5,700,000	0.20	12.1	Pine, fir, cypress, camphor, liquidambar, ailanthus.
Anhwei.........	2,000,000	0.10	5.7	Maple, fir, oak, larch, torreya.
Kiangsu [1].......	....	....	....	....
Chekiang........	2,000,000	0.20	8.4	Cryptomeria, oaks, chestnut, larch, cunninghamia, camphor...................

Southern Provinces

Province	Forest area	Forest per capita	Per cent forested	Most valuable tree species
Yunnan.........	23,700,000	1.80	25.3	Tropical forest in southwest, oak, ash, elm, chestnut, pine, fir, larch; cunninghamia, camphor.
Kweichow.......	4,300,000	0.50	10.3	Pine and fir.
Kwangsi........	3,000,000	0.60	6.1	Pine, fir, cypress, camphor, chestnut.
Kwangtung......	6,000,000	0.20	9.4	Oak, chestnut, camphor, liquidambar, pine, fir.
Fukien..........	6,000,000	0.30	20.3	Oak, chestnut, maple, tallow, camphor, pine, larch; and sycamore, pistachia, yew, cryptomeria, magnolia in south.
Total China proper......	120,000,000	0.40	12.2	....

TABLE 193.—FOREST DISTRIBUTION, CHINA—*Continued*

Outer Territories

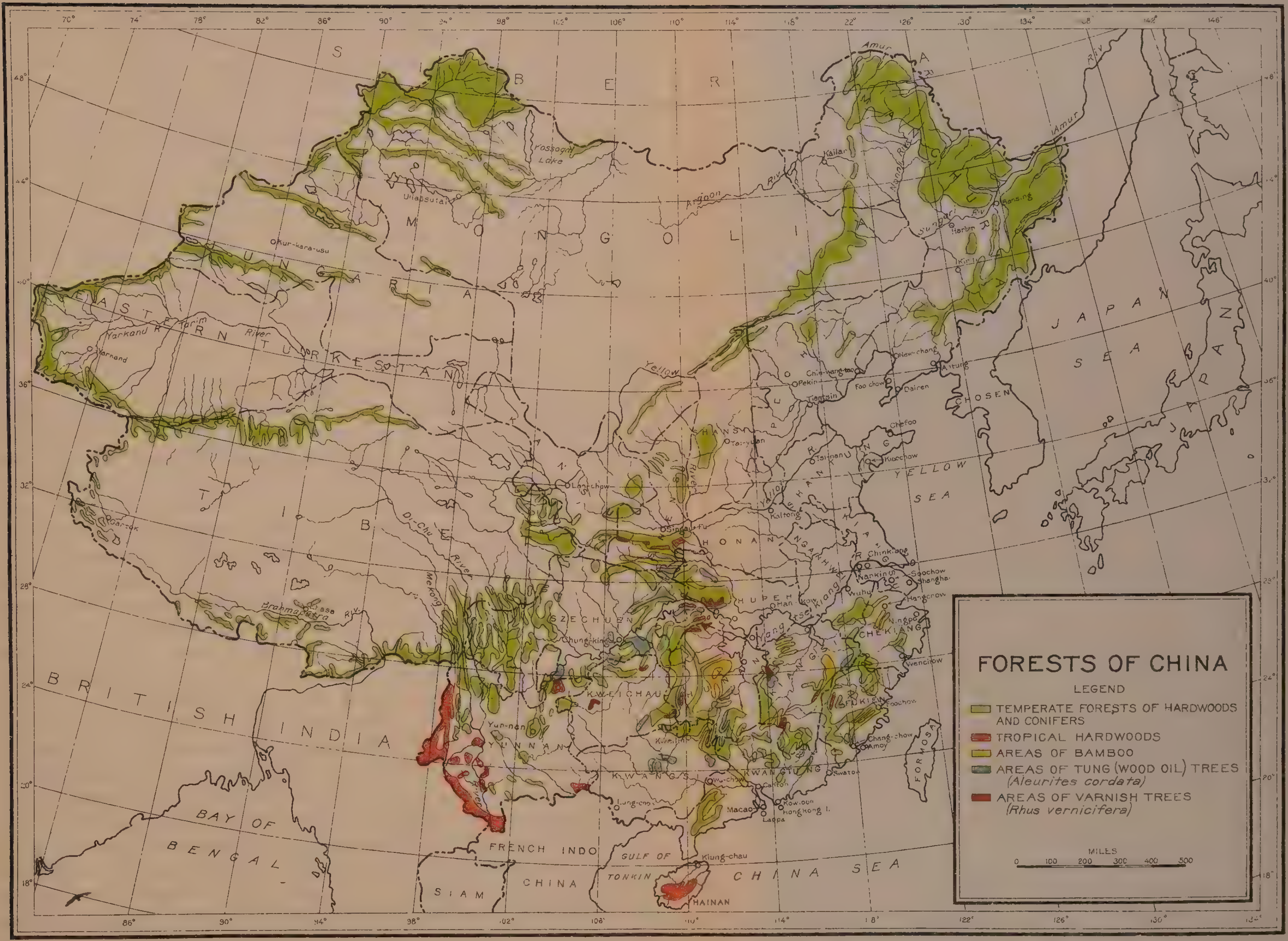
Territory	Forest area	Forest per capita	Per cent forested	Most valuable tree species
	acres	*acres*		
Tibet	4,000,000	0.60	1.3	Good forests in southwest, mostly conifers, at least 4 million acres adjacent to Szechwan and Yunnan.
Mongolia[1]	. . . . . .	. . . . . .	. . . . . .	Considerable areas of coniferous forest, but very small compared with size of province.
Sinkiang (Chinese Turkestan)[1]	. . . . . .	. . . . . .	. . . . . .	Considerable area of good coniferous forest on middle slopes of high mountain ranges. Small in proportion to total.
Manchuria	64,800,000	7.60	27.8	North of Sungari River—fir, larch, aspen, elm, oak, birch, pine, spruce in south. South of Sungari River—oak, ash, walnut, poplar, spruce, fir, pine, larch.

[1] No definite figures are available.

Wholesale destruction has denuded a large part of China of its forests, and the country now has to import timber to satisfy its own needs for the higher grades and larger sizes. The original forest area in China is difficult to determine because of the long history of the country. Large forests in China proper are now rare; they are found only in certain districts of Central Asia and southern Tibet and in Manchuria.

Character of the Forest—China Proper.—The forests of China proper lie in three main regions: (1) the Nan Shan or Nanling Range; (2) the central region, chiefly in the Tsingling-Shan and Chiutiao Shan; and (3) the western highland region. There are also a few outlying forest areas toward the north boundary.

(1) The Nan Shan is a very rough high mountain mass extending from the western plateau nearly parallel to the south coast along the north boundaries of Kwangsi and Kwangtung and the west edge of Fukien to central Chekiang. Much of it is inhabited by wild tribes who have never been conquered by the Chinese, hence much virgin timber is left.



FORESTS OF CHINA

This timber is hard to get at, and the forest cover should be kept intact in order to protect the headwaters of the many rivers rising in the range. A good deal of timber and firewood is now being cut. In Hupeh, fir and pine are grown as crops over large areas on very short rotation. The vegetation on the south side of the range is more or less subtropical in character; at the highest elevation conifers predominate.

(2) The central region consists of mountains in Shensi, Honan, Szechwan, and Hupeh provinces, also spurs from the great western highlands. Considerable quantities of timber are still being cut from these mountains, but much of the remaining forest is rather difficult of access, and here, as in the Nan Shan, watershed protection should be paramount, since on her rivers depends to a large degree China's commerce and to some extent her agriculture and her enormous fish industry. The district contains good virgin forest, mostly conifers. There is much bamboo, especially in the Nan Valley.

(3) The great western plateau of Szechwan and Yunnan is partly inhabited by semi-independent savage tribes and is mostly inaccessible. With railroad development it may be able to supply some lumber to the rest of the country. In the southwest, in the valleys of the Mekong, Salween, and Irawaddy rivers, the forest is tropical jungle, merging farther north into temperate hardwoods and at high elevations into coniferous forests which extend into southern Tibet. There are isolated forests in inaccessible places in Shansi, Shensi, and Chihli.

In general, such forest as remains has been preserved because it could not be reached, either because of the savage tribes of the mountains or because there were no drivable streams on which to float out the timber. There had been no attempt at control of the national forest resources until within very recent years.

Manchuria contains the chief district of extensive primeval forest in China. It reaches from the Yalu River northeast to the Ussuri with scarcely a break, and from there northwest to the Argun, extending over a thousand miles and containing vast stores of timber. This magnificent resource is an invaluable asset to China, and its conservation is of the greatest importance. The species include spruce, silver fir, red pine, and larch, and oak is also present in large quantities, but the most valuable timber is Manchurian pine (*Pinus mandshurica*). The eastern mountains contain the heaviest forests and the best timber; pines over 200 feet high and 5 feet in diameter are not uncommon. Although the best forests are still remote from means of transportation and have been but little exploited, the choice timber has been entirely removed from the hills along the Chinese Eastern Railway. In addition to heavy saw timber, these forests supply Russia and China with much wood for railway ties, and the entire fuel supply of the Chinese Eastern Railway comes from them.

Regarding the forests of Tibet, Eastern Turkestan, and Mongolia little is known, except that they are small in proportion to the total areas of the provinces and very difficult of access.

The species of economic importance in China are:

Birch (*Betula alba*) (Chinese name—Hua, or Tan). There are several species of birch, among which *Betula alba* occurs on mountain slopes and reaches a diameter of from 2 to 3 feet. *Betula costata* is found from Bureya to Ussuri, and *Betula bhojpattra* on the Yalu. Birch is used for making walking sticks, bowls, and especially cart axles. The bark of *Betula alba* is used to make waterproof mats, canoes, pails, and so on. In northwestern Szechwan (Mantzu land) there are forests of *Betula utilis* which cover a vast extent of territory.

Ash (*Fraxinus chinensis*) (Chinese name—Huai). This species attains its best development in Manchuria, where it grows to a height of 100 feet and a diameter of over 6 feet.

Alder (*Alnus cremastogyne*) (Chinese name—Pa).

Beech (*Fagus sinensis*) (Chinese name— Peh litzu).

Other hardwoods:

- Willow (several species) (Chinese name—Yang).
- Chestnut (several species) (Chinese name—Li).
- Elm (several species) (Chinese name—Yu).
- Basswood (several species) (Chinese name—Tuan).
- Maple (several species) (Chinese name—Se).
- Oak (several species) (Chinese name—Che, Tso, and several others).
- Poplar (several species) (Chinese name—Yang). Of rather rare occurrence.

Tallow tree (*Stillingia sebifera*) (Chinese name—Chiu). Tallow for the manufacture of candles is obtained from the fruit of this tree.

T'ung tree (*Aleurites cordata*) or wood-oil tree. This is the national tree of China and has many local names. The oil is obtained from the nuts and is poisonous when fresh.

Varnish tree (*Rhus vernicifera*) (Chinese name—Chi). This tree yields the lacquers of the Far East. The varnish is secured by tapping the tree.

Among the conifers the following are the most important:

Fir. There are several species of *Abies*, but the best known fir, *Cunninghamia sinensis* (Chinese name—Sha).

Larch (*Larix leptolepis*) (Chinese name—Lo yeh sung (deciduous pine), or Huang hua sung (yellow-flower pine)).

Pine (Chinese name—Sung). Of the pines *Pinus sinensis*, *Pinus mandshurica*, and *Pinus bungeana* are the most important.

Spruce (*Picea*) (Chinese name—Sha). Several species occur in China. The principal spruce in the east Manchurian forest is *Picea hondoensis.*

There are 40 identified species of bamboo in China. Bamboo serves many purposes for which wood is used in other countries. For China as a whole, it is estimated that conifers occupy about 45 per cent of the forest area, and hardwoods 55 per cent.

Character of Ownership.—There are no definite data regarding the ownership of the forests. It is known, however, that large areas are owned by the public in one form or another.

Annual Consumption, Cut, and Growth.—No reliable statistics are available for the growth, cut, and consumption of wood in China. Judging from what is known concerning the consumption of wood in countries with somewhat similar conditions of living, the per capita consumption of wood, not including bamboo, is estimated at approximately 6 cubic feet. For the country as a whole the annual consumption of wood is probably almost 2 billion cubic feet. Of this only about 15 per cent is saw-timber.

As the net imports of wood into China are relatively small in amount, most of the wood consumed is cut from the native forests. The annual cut is estimated at approximately 1,972,000,000 cubic feet, of which about 284,000,000 cubic feet is saw-timber.

Although the forests of China have been heavily overcut in the course of several thousand years, a great part of those remaining are difficult of access and still comparatively unexploited, and it is believed that the forest area is now practically stationary. If this is true, the annual growth is probably about equal to the cut. This does not mean, however, that China's forest area is adequate for her needs. The growth balances the cut only because the cut is so small, and if the forests were nearer to the centers of consumption they would have been cut off long ago, and would not now be able to supply even the low requirements of China.

External Timber Trade.—*Imports.* The average annual net imports of softwoods into China for the period 1909–13 were 118,544,044 board feet, valued at $2,016,445, and of hardwoods, 46,301,832 board feet, valued at $959,036. The distribution of this import among the different countries of origin is shown in Table 194.

The softwood lumber imported in 1913 was received at 32 ports in China, as given in Table 195.

As may be seen, of the 32 ports only 10 took amounts in excess of one million feet. Shanghai ranks first and Tientsin second, followed by Hankow, Dairen, Nanking, and Kiaochow (Tsingtau).

An interesting fact is that while in 1909 the United States contributed practically half of all the hardwoods imported into China, in 1913 no

TABLE 194.—IMPORTS AND EXPORTS OF TIMBER, CHINA.

Country of origin	Imports—Softwoods[1]				Imports—Hardwoods[1]				Other forest material[2]		Total imports		Exports[2]	
	Quantity	Per cent	Value	Per cent	Quantity	Per cent	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent
	bd. ft.				*bd. ft.*									
Hongkong	665,593	0.6	$ 13,540	0.7	9,834,952	21.2	$334,900	34.9	$286,301	41.2	$ 634,741	17.3	$ 398,059	27.8
Macao	169,106	0.2	3,031	0.1	620,760	1.3	15,407	1.6	4,429	0.6	22,867	0.6	153,842	10.8
French Indo-China	25,727	...	725	...	387,436	0.8	8,467	0.9	36,105	5.2	45,297	1.2	11	...
Singapore, Straits, etc	13,038	...	292	...	5,626,732	12.1	122,202	12.7	19,255	2.8	141,749	3.9	6,824	0.5
Great Britain	11,461	...	319	...	32,712	0.1	1,683	0.2	1,105	0.2	3,107	0.1	347	...
Sweden	271,990	0.2	6,037	0.3	...	...	...	...	...	...	6,037	0.2	...	...
Russia, European ports	162,885	0.1	2,700	0.1	...	...	...	...	...	...	2,700	0.1	...	...
Russia and Siberia, land frontier	892,077	0.8	66,790	3.3	...	...	...	...	33,544	4.8	100,334	2.7	3,757	0.3
Russia, Pacific ports	2,000,006	1.7	37,667	1.9	71,560	0.2	1,381	0.1	8,895	1.3	47,943	1.3	68,027	4.8
Chosen	2,962,282	2.5	43,506	2.2	34,180	0.1	716	0.1	16,734	2.4	60,956	1.7	132,074	9.2
Japan (including Formosa)	55,170,007	46.5	872,300	43.3	16,711,160	36.1	327,957	34.2	261,281	37.6	1,461,538	39.8	641,844	44.9
Philippine Islands	9,667	...	123	...	212,528	0.5	4,709	0.5	...	...	4,832	0.1	...	...
Canada	22,975	...	483	...	...	...	...	...	65	...	548	...	...	...
United States (including Hawaii	55,907,693	47.2	965,538	47.9	10,832,952	23.4	74,975	7.8	2,402	0.3	1,042,915	28.4	...	...
South America	259,537	0.2	3,394	0.2	...	...	...	...	...	...	3,394	0.1	...	...
Siam	...	...	...	...	130,204	0.3	7,409	0.8	972	0.1	8,381	0.2	251	...
Dutch Indies	...	...	...	...	78,476	0.2	5,038	0.5	11,123	1.6	16,161	0.5	9,388	0.7
British India	...	...	...	...	189,104	0.4	12,279	1.3	8,226	1.2	20,505	0.6	78	...
Germany	...	...	...	...	2,008	...	39	...	330	0.1	369	...	73	...
Austria-Hungary	...	...	...	...	707,664	1.5	23,187	2.4	...	...	23,187	0.6	...	...
Australia, New Zealand	...	...	...	...	829,404	1.8	18,687	2.0	333	0.1	19,020	0.5	...	...
Turkey, Persia, etc	...	...	...	...	...	...	...	...	18	...	18	...	...	...
Belgium	...	...	...	...	...	...	...	...	474	0.1	474	...	...	...
France	...	...	...	...	...	...	...	...	528	0.1	528	...	...	...
Spain (including Gibraltar)	...	...	...	...	...	...	...	...	128	...	128	...	...	...
Portugal	...	...	...	...	...	...	...	...	1,271	0.2	1,271	0.1	...	...
Italy	...	...	...	...	...	...	...	...	70	...	70	...	...	...
Russia, Amur ports	...	...	...	...	...	...	...	...	568	0.1	568	...	14,942	1.0
Total	118,544,044	100.0	$2,016,445	100.0	46,301,832	100.0	$959,036	100.0	$694,157	100.0	$3,669,638	100.0	$1,429,517	100.0

Total imports, softwoods and hardwoods: 164,845,876 board feet, or 13,737,156 cubic feet.

[1] Average of three years, 1909, 1911, 1913.

[2] Average of five years, 1909–1913.

TABLE 195.—IMPORTATION OF SOFTWOOD LUMBER INTO CHINA, BY PORTS.

Port	Feet B. M.	Value
Manchouli	2,006,426	$ 29,131
Antung	1,029,848	17,510
Dairen	20,234,956	352,319
Newchang	1,360,745	23,926
Chingwangtao	700,197	12,206
Tientsin	25,740,196	452,573
Chefoo (Chifu)	108,307	1,889
Kiaochow	4,659,991	81,303
Ichang	52,318	917
Shasi	14,009	245
Changsha	467,884	81,632
Yochow	56,850	992
Hankow	20,780,124	362,552
Kiukiang	967,958	16,956
Wuhu	174,073	3,038
Nanking	5,446,957	90,886
Chinkiang	284,101	4,956
Shanghai	75,316,620	1,360,209
Soochow	3,000	60
Hangchow	50,000	872
Ningpo	1,656,178	29,560
Wenchow	3,476	101
Foochow	1,908	36
Amoy	29,443	837
Swatow	65,894	1,232
Canton	147,595	2,758
Kowloon	122,105	2,643
Kowloon (railway traffic)	36,854	688
Lappa	290,315	5,425
Wuchow	1,000	18
Kiungchow	7,271	169
Lungchow	34,751	1,015
Total	161,851,350	2,938,649

imports of hardwoods from the United States are given. In that year the bulk of the hardwood imports came from Japan, followed next by Singapore and the Straits Settlements. The hardwoods reported as having been imported from Hongkong are unquestionably composed largely of shipments from Borneo, the Philippine Islands, and the Straits, reaching Hongkong by regular steamship lines. Table 196 gives the ports which participated in 1913 in the distribution of the hardwood imports.

In addition to lumber, China imports large quantities of wood of different species and in various forms, such as rough and hewn logs,

TABLE 196.—IMPORTATION OF HARDWOODS INTO CHINA, BY PORTS

Port	Feet B. M.	Value	Port	Feet B. M.	Value
Suifenho	25,200	$ 460	Hangchow	6,000	120
Antung	52,284	1,081	Ningpo	241,956	46,827
Dairen	1,149,324	25,402	Foochow	135,852	2,857
Newchang	793,848	15,791	Amoy	149,892	2,776
Chingwangtao	304,500	9,362	Swatow	161,316	2,963
Tientsin	9,614,448	215,144	Canton	457,680	8,240
Kiaochow	287,796	7,369	Kowloon	6,620,760	141,301
Ichang	1,596	31	Kowloon (railway traffic)	12,672	224
Changsha	512,628	10,197			
Hankow	2,235,336	46,859	Lappa	1,035,732	26,341
Kiukiang	142,392	2,470	Kongmoon	41,436	738
Wuhu	74,340	1,479	Samshui	30,756	545
Nanking	72,120	1,434	Wuchow	9,756	54
Chinkiang	7,920	223	Kiungchow	35,076	832
Shanghai	8,170,320	236,027	Lungchow	169,320	4,120
Soochow	38,748	771			
Total				32,591,004	$812,038

ties, spars, mine lagging, staves, shooks, posts, poles, veneers, lath, and shingles. No data as to quantities are available but the total value in 1913 exceeded $840,000. Even these imports do not include sandalwood and dyewoods. China uses large quantities of sandalwood, which is employed in the making of incense. During the period 1913–16 over 6,164 tons of sandalwood was imported, valued at $647,000.

The average annual imports of all wood into China (not including sandalwood) may therefore be placed at 164,845,876 board feet, or 13,737,156 cubic feet. For such a densely populated country as China, with an undeveloped home sawmill industry, the imports are comparatively small. The bulk of the imported lumber at present finds its main use in the cities and open ports where the foreign residents demand it. Only a small percentage of all the importations is reshipped to interior points.

Exports.—China is credited with exports of timber valued at about $1,400,000. These exports, however, are largely shipments into contiguous territory or reshipments. The actual amount exported from the native forests is on the whole negligible; it consist of low-grade wood and is used in the cheaper class of buildings.

Internal Timber Trade.—Timber exports (largely from Manchurian ports, Harbin, Dairen, Antung, Tatung Kow), almost exclusively for local internal trade, averaged about 470,000 cubic feet of hardwoods, 2,500,000 cubic feet of softwoods and 900,000 poles per annum (average for 1913–16). Much of this (probably nearly all of the export from China proper) goes to Hongkong, Macao, and Kiauchau, European towns which use much wood and have none of their own. The Shantung peninsula, through Kiauchau, imported in 1916 approximately 1,062,000 cubic feet of softwoods. Five hundred thousand cubic feet goes from Kwangtung ports, presumably to Hongkong and Macao. A large local trade in firewood is carried on between Chinese ports and also with the European ports in China. The average exports from Chinese ports are about 100,000 cords.

While small quantities of timber are still available in many districts in China, 3 districts deserve special attention because of the total volume of their trade in timber and because of the wide domestic market they supply: (1) Manchuria, (2) Yuan River basin, and (3) the Mien River District of Fukien.

1. *Manchuria,* consisting of the three eastern provinces of Fengtien, Heilungkiang, and Kirin, comprises by far the best timbered region remaining in China, not only because of the extent and variety of its timber but also because of its comparative accessibility and of the ease with which the forests can be worked on a large scale and by modern logging methods. Manchuria will become more and more important as the country is opened up by railroads. At present the timber trade centers in Manchuria principally in two districts, Kirin, comprising chiefly the areas tapped by the Sungari River and its tributaries, and the basin of the Yalu River and its tributaries, the timber from which finds its outlet at Antung. The value of timber exported from Antung in 1916 was $1,313,700.

2. *Yuan River Basin.*—This river, with its tributaries, taps the rich forest area in the southern and western portions of Hunan province and also the principal forest bearing portions of the adjacent province of Kweichow, and the region as a whole constitutes one of the chief native sources of supply. Most of the timber passes through Tungting Lake to the Yangtze, whence it is widely distributed both up and down the river. Extensive plantations of "China fir" and pine occur and contribute largely to the total output.

3. *The Mien River District of Fukien.*—Although this district still figures prominently as one of the chief sources of native timber supply, its forest wealth, and therefore its importance in timber trade, show, on the average, a notable decrease as compared with former years, as a result of excessive forest destruction. Foochow poles (fir and pine) are the chief feature of the domestic timber industry. The main supply of timber in the province of Foochow is in the prefectures of Yenping, Kienning, Shaowu, and Tingchou.

Foochow (32 per cent), Hankow (30 per cent), and Antung, the port of export for Manchurian timber brought from the Yalu (16 per cent), supply most of the timber passing through the Internal Customs.

Native timber comes in small sizes because of the heavy overcutting of the forests and the resulting short rotations. There are sawmills at Foochow, Shanghai, Wenchow, Ningpo, Dairen, and Antung. Considerable wood is used in China, but the lack of it is more or less made up for by the abundant bamboo of which very large areas are cultivated.

Wood-Using Industries.—China has not a large number of wood-using industries. Thousands of small native shops or factories exist where wood is used as the material for turning out some article for local consumption. These shops, as a general rule, use native woods to which they are accustomed and which can ordinarily be obtained at a lower price than the imported material. One large consumer of wood is the match industry, which even imports ready-cut wood from Japan. China produces annually some 5,000,000 gross of matches.

A number of tree products which may be considered agricultural rather than forest crops are very important in Chinese export trade as well as for home consumption. These include star aniseed, camphor, fungus (from oak), nut galls (export 6,500,000 pounds a year), resin (6,500,000 pounds in 1916), varnish (from the varnish tree, 2,000,000 pounds a year), wood oil (from the tung tree, 40 to 60 million pounds a year).

The Forestry Movement.—Forestry is now receiving the attention of the Chinese Government, and a Chinese Forest Service was created in January, 1916, under a Department of Forestry in the Ministry of Agriculture and Commerce. A number of agricultural experiment stations have been established. Two of these, at Chang-chinghsien, Shantung, and Purple Mountain, Nanking, deal with forestry. The best evidence of increased interest in practical forestry in China is the large number of agricultural and forestry organizations that have recently engaged in the raising and planting of forest trees. The First Provincial Forestry Station, Kiangsu, raised 3 million seedlings and transplants in 1918. The College of Agriculture and Forestry of the University of Nanking is developing extensive nurseries and a seed department from which planting material is sold at the lowest possible prices. Several government railways have started nurseries to supply trees for ties and building timber.

The Forest Service of China aims to reforest idle lands and the principal watersheds; to protect the present forest resources by scientific management; to carry on systematic propaganda throughout the country, teaching the evils resulting from destruction of forests and the steps to be taken to remedy these evils; to train young men for forestry work;

and to introduce courses in forestry instruction in the existing educational institutions.

The Probable Future.—The entire railroad mileage of China amounts to only about 7,000 miles. The number of wood-using industries is very small. With large plans for the building of railroads and general industrial development, the demand for lumber in China will greatly increase.

From the United States and Canada China receives principally saw timber. Eventually, when the country enters upon active construction of railroads, the demand for timber will increase enormously. When she becomes an industrially developed country China, with her 331 million people, will be a large buyer of wood in the world's market.

In view of the limited timber supply in China, there is a great and growing demand for forest products in practically all phases of industrial development. These needs call not only for a better quality of wood than her limited resources supply, but for larger sizes and far greater quantities. For some years China has been in the transient stage of becoming the center of industrial enterprises in the Far East, and the speed of this transformation has been and will continue to be greatly accelerated by the introduction and development of railroads which present, therefore, perhaps the greatest need for lumber. The timber for railroad bridges, cofferdams, stations, and bodies of freight cars has been for about 13 years supplied by Douglas fir. It has been estimated that the railroads already in operation in China will require for repair and upkeep more than 23,000,000 board feet of timber annually. This for a period of the next 6 years would call for 138,000,000 board feet of timber. In addition to this, 9,530 miles of railroads are estimated to be either in the process of construction or under projection. With an estimate of 50,000 board feet of lumber needed per mile for construction purposes, that would mean a demand for 475,000,000 board feet. Together with the estimated amount required for repair on the existing roads, 138,000,000 board feet, this makes a grand total of over 600,000,000 board feet of lumber to be furnished to China in the next six years. With the Far Eastern supply so limited, it is probable that 80 per cent of this demand is an open market for the western coast of the United States.

Inasmuch as railroad development stimulates further industrial development in China and will contine to do so to an increasing extent, the construction of factories, mills, public works, dwelling houses for foreigners, government buildings, and river and canal improvements will stimulate the importation of American and Canadian lumber. In addition, with the advance of commerce, the construction and maintenance of harbors, the inevitable opening of further treaty ports, and the continued growth of present treaty ports will further accentuate the necessity of this importation.

Hongkong

Hongkong is an important British island possession situated off the southeast coast of China. The island was ceded by China to Great Britain in 1841. Since then additional territory contiguous to the island has been leased to Great Britain for 99 years (1898). There are practically no commercial forests of any value from Hongkong to the New Territories. The only source of timber supply is a native pine, *Pinus massoniana,* and some other trees which are cut from the island. The pine is used for fuel only; the other trees are used for fuel and for making handles for garden and agricultural implements. The traffic in these native species is local, and is carried on only between inland and seaside fishing villages. All of the timber used in Hongkong and the New Territories is imported from other countries except "China fir" (*Cunninghamia sinensis*), of which considerable quantities are imported from South China. Table 197 shows the imports of timber for 1919.

Table 197.—Imports of Timber for 1919—Hongkong

Country	Hard-wood	Oak	Teak	Other hardwoods	American pine	Other softwoods	Woods not specially mentioned
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
United Kingdom	....	....	....	2,210	....	....	2,333
Canada	....	....	....	....	121,921	225,526	907
Burmah	....	....	....	24,400	....	....	....
Straits Settlements	....	....	....	19,782	....	30,288	118,506
British North Borneo	390,858	....	....	517,897	....	....	6
North China	....	....	....	....	625	....	48
Japan	....	14,000	....	4,000	....	438	16,667
Netherlands East Indies	710	....	13,235	12,103	....	....	6
Indo-China	13,173	....	37,280	18,418	....	....	4,504
Siam	4,000	....	409,615	8,585	....	....	630,307
Philippine Islands	20,696	....	....	54,592	....	5,945	....
United States	....	....	....	42,960	173,720	188,533	2,304
Australia	....	....	....	....	....	....	242
Total	429,437	14,000	460,130	704,947	296,266	450,730	775,560

Large quantities of the stems of *Rhapis flabelliformis* are straightened and hardened by fire and roughly trimmed, after which they are exported to Europe, where they are sold as walking sticks and umbrella handles under the trade name of "partridge cane."

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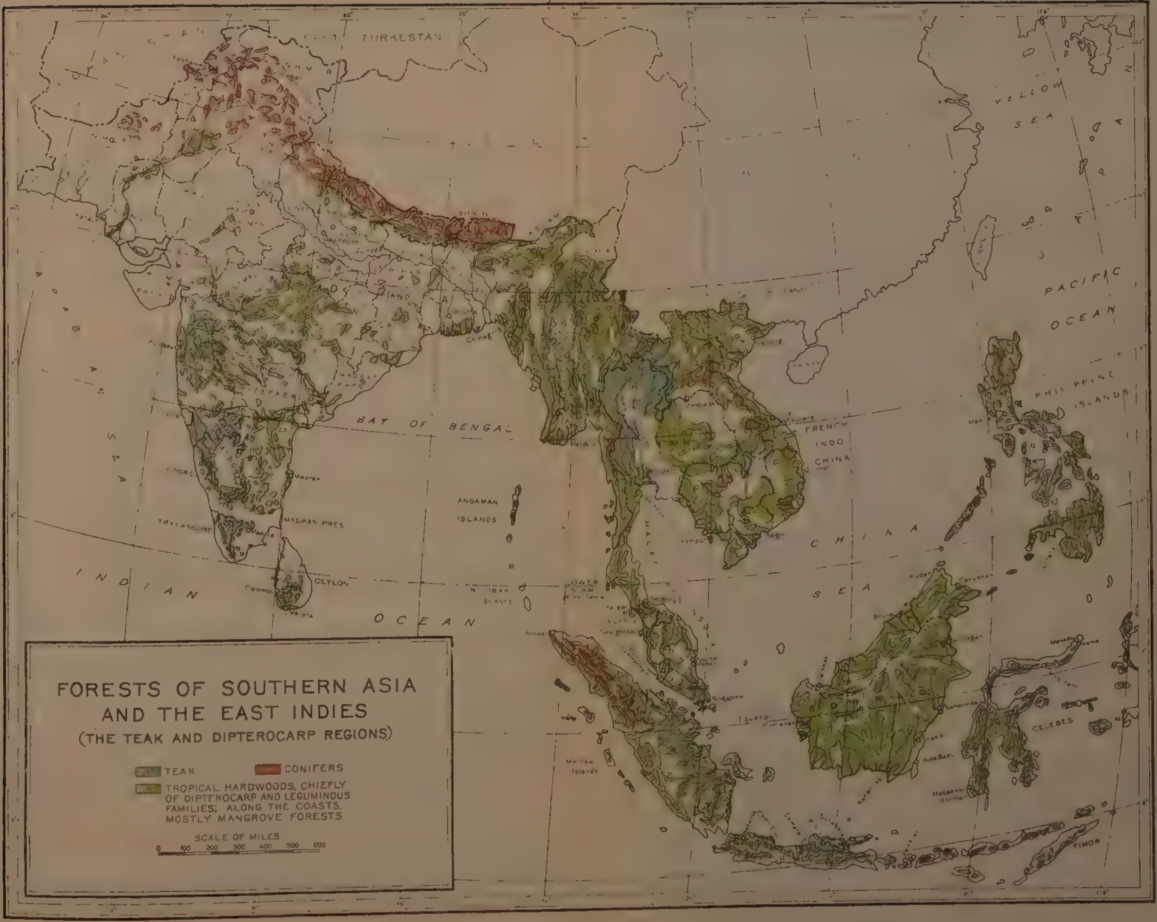

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NETHERLANDS EAST INDIES

The principal Dutch colonies in the East Indies are Java and Madura, 32,384,000 acres (50,600 square miles), Sumatra, 114,136,320 acres (178,338 square miles), Dutch Borneo, 129,382,400 acres (202,160 square miles), Celebes, 46,124,800 acres (72,070 square miles), and New Guinea, 97,280,000 acres (152,000 square miles). Their total population is 47,000,000, of which Java has about three-fourths. All of these colonies are rich in forests, but definite data regarding them are very incomplete.

All the islands of the archipelago, apart from Java and Madura, are known under the names of "Outer Territories" or "Outlying Possessions."

Extent of Forest Area.—The forest area of all the Dutch East Indies, including Dutch New Guinea, is about 232,000,000 acres, distributed as follows:

TABLE 198.—FOREST AREA OF NETHERLANDS EAST INDIES

Island	Total land area	Forest area	Per cent of land area
	acres	*acres*	
Java and Madura	32,384,000	7,163,000	22
Sumatra	114,136,320	28,500,000	25
Dutch Borneo	129,382,400	103,506,000	80
New Guinea[1]	97,280,000	77,824,000	80
Celebes	46,124,800	12,330,000	27
Other islands	51,175,480	2,840,000	6
Total	470,483,000	232,163,000	49

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[1] Dutch New Guinea is a part of Oceania and its forest area has been omitted in the total for Asia. It is discussed here as it is a part of Dutch East Indies.

Java and Madura

Forest Area.—The forests of Java and Madura are estimated at 7,163,000 acres, or about 22 per cent of the land area; practically all is government forest, and two-thirds of it reserved, the rest being under the control of the magistrates, who are advised by foresters. The forest area, as far as it has been explored, may be divided into teak or djati forests and wild forests.

1. *Teak Forests.*—These consist entirely or for the most part of teak (*Tectona grandis* L.). They are found chiefly in the lower hill regions of central and eastern Java. At an elevation of more than 2,000 feet above sea level the growth is unsatisfactory. At the end of 1918 the teak forests had an area of about 1,803,100 acres; of this 36 per cent was organized into forest districts or managed under a definite working plan.

2. *Wild Forests.*—In 1918 these forests comprised an area of 3,153,200 acres of reserved land, of which 59 per cent was surveyed and definitely located, and 2,206,700 acres of unreserved and waste land. The unreserved forests are destined for clearing for agricultural use, and they are being diminished every year through new clearings by the natives as well as by granting of long leases for large agricultural enterprises. The permanent forest area may, however, be considered in the neighborhood of 5 million acres. The number of species composing the wild forests amounts to more than 1,200. With a few exceptions, such as the *Casuarina* and bamboo forests in eastern Java, the wild forests are made up of a great variety of species. The great importance of the wild forests at present is not so much in the value of the timber as in their influence upon stream-flow. The plans considered within the last few years for utilizing the available water power on a big scale have still more emphasized the value of forest protection in the mountains. In a country like Java, where agriculture is dependent to a great extent on regular water supply in the plains, the influence of the forests is of the greatest importance.

Cut.—The cut of teak in 1916 amounted to 6,572,931 cubic feet of timber and 27,342,067 cubic feet of firewood. Besides these amounts, the teak forests in 1916 supplied the following quantities of other wood and forest products:

46,243	cubic feet of timber
442,732	cubic feet of fuel
4,111,904	pounds of charcoal
624,162	pounds of bark
371,361	pounds of cane
36,470	pieces of bamboo
3,191,826	cubic feet of bamboo for fuel

TABLE 199.—CUT IN TEAK AND WILD FORESTS OF JAVA

Year	Production of teak timber				Production of teak firewood	Export of teak timber	Area of wild forest to be reserved	Yield of wild forests[2]			
	Total	Timber felled						Total		Timber felled by Forestry Service	
		Under control of Forestry Service	By contractors	By irregular exploitation				Timber	Firewood	Sawlog timber	Firewood
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*acres*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
1912.	8,721,642	4,276,666	4,196,217	248,759	22,098,782	1,724,723	2,466,048	444,886	2,067,441	222,143	1,260,375
1913.	9,529,093	5,107,133	4,161,058	260,902	27,421,070	1,383,265	2,531,009	469,737	1,547,826	255,219	1,326,448
1914.	8,100,220	4,819,332	3,077,030	203,858	26,259,921	1,217,815	2,607,332	469,490	2,654,458	299,415	1,767,386
1915.	6,096,980	3,057,933	2,856,405	182,642	20,833,118	702,964	2,954,614	867,003	2,199,168	669,888	1,634,052
1916.	6,572,931	3,851,442	2,588,761	132,728	27,342,067	534,443	3,124,056	666,393	2,262,119	398,537	1,591,090
1917.	9,219,512	6,483,833	2,622,013	113,666	35,678,394	1,765[1]	3,140,852	643,484	3,439,158	370,509	2,350,139
1918.	7,719,863	5,498,610	2,117,612	103,641	28,612,880	41,830[1]	3,153,202	986,988	3,503,227	653,050	2,482,775

[1] To Europe only.

[2] No account is taken here of timber cut on private estates and on estates which are being opened up on long lease, because no data regarding these are available.

The wild forests in 1916 furnished 666,393 cubic feet of timber and 2,262,119 cubic feet of firewood. This represents a total cut of all kinds of wood in 1916 of 40,524,311 cubic feet; the cut per acre is 5.7, and the cut per head of population is 1.2 cubic feet.

Imports and Exports.—The export of teakwood in 1916 amounted to 534,443 cubic feet, a considerable reduction from the cut of previous years. The export of teakwood from Java is continually decreasing. The wild forests on the whole are composed of species inferior to teak, which are not exported. The cut in the teak and wild forests from 1912 to 1918, and the export of teakwood for the period between 1903 and 1916, are given in Tables 199 and 200.

TABLE 200.—TOTAL EXPORT OF TEAK, 1903–1916

Year	Cu. ft.	Year	Cu. ft.	Year	Cu. ft.
1916.......	534,443	1911.......	1,902,105	1906.......	2,291,464
1915.......	702,964	1910.......	2,288,428	1905.......	2,147,158
1914.......	1,217,815	1909.......	1,583,100	1904.......	1,100,583
1913.......	1,383,265	1908.......	1,490,825	1903.......	990,906
1912.......	1,724,723	1907.......	2,315,927		

The export of teak since 1907 was distributed among the countries of destination as shown in Table 201.

TABLE 201.—DESTINATION OF THE TEAK EXPORTED, 1907–1916

Year	Europe		Africa	Asia		Elsewhere	Total
	Total	To the Netherlands or order		Total	To Hindustan		
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
1916	519,016	493,107	....	11,861	11,861	3,566	534,443
1915	600,171	478,527	....	100,534	70,741	2,259	702,964
1914	994,401	370,685	....	208,341	206,011	15,073	1,217,815
1913	1,234,476	523,923	....	130,257	130,257	18,532	1,383,265
1912	1,351,178	453,746	180,383	151,649	143,848	41,513	1,724,723
1911	1,403,493	489,893	142,859	341,280	330,655	14,473	1,902,105
1910	1,268,223	365,602	610,196	374,074	349,046	35,935	2,288,428
1909	811,018	279,117	234,110	521,875	506,308	16,097	1,583,100
1908	779,248	329,596	291,331	348,199	344,704	72,047	1,490,825
1907	1,207,895	Unknown	891,996	176,782	Unknown	39,254	2,315,927

The character of the export, as well as the ports of export, are given in Table 202.

TABLE 202.—QUANTITIES OF TEAK EXPORTED DURING 1916

Countries of destination and ports of shipment	The quantity exported consisted of			
	Railway ties	Other timber		Total quantity exported
		Sawn	Unsawn	
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*
Europe:				
Netherlands	12,426	20,298	460,383	493,107
England	...	882	20,862	21,744
The rest of Europe	247	...	3,918	4,165
Total	12,673	21,180	485,163	519,016
Asia:				
Hindustan	...	1,271	10,590	11,861
Total	...	1,271	10,590	11,861
Australia	...	2,577	424	3,001
Destination unknown	...	565	...	565
Grand total	12,673	25,593	496,177	534,443
Ports of shipment:				
Surabaja	9,743	15,391	303,015	328,149
Cheribon	...	4,766	...	4,766
Semarang	2,930	4,483	173,288	180,701
Toeban	...	...	19,874	19,874
Other ports	...	953	...	953
Total	12,673	25,593	496,177	534,443

Consumption.—Since the total cut of timber in Java and Madura amounts to 40,524,311 cubic feet, and the export for the ten years 1907 to 1916 averaged 1,514,360 cubic feet, the consumption amounts to 39,009,951 cubic feet. With a population of 34 million this represents an annual consumption of 5,771,207 cubic feet (0.2 per capita) of timber and 33,238,744 cubic feet of fuelwood (1.0 foot per capita), or a total of 1.2 cubic feet per head of population.

Sumatra

With a total area of 114,136,320 acres (178,338 square miles) and a population of 5 million, Sumatra ranks high as a timber country. A much larger proportion of its area is timbered than is the case with Java, since the timber comes down nearer to sea level. If only 25 per cent is considered as forested, there are at least 28,500,000 acres of forest. Some of the forests contain a great deal of teak. In southern Sumatra there are at least 17,290 acres of forest consisting almost entirely of ironwood (*Eusideroxylon zwageri*). The dipterocarps are important timber trees of Sumatra, and there is also a valuable pine in the northern part of the island. Gums, resins, and gutta-percha are important exports.

Dutch Borneo

Of the 185,510,400 acres (289,860 square miles) in Borneo, the Dutch control 129,382,400 acres (202,160 square miles) and the British the rest. The population is about 1.5 million. It is stated that the greater part of the island is covered with forest. If we assume about 80 per cent timber forest, the forest area may be taken as about 103,506,000 acres.

There are about 60 merchantable species of timber of which the principal ones now cut are "tapan" and "ironwood." British North Borneo, and probably Dutch Borneo too, export rubber, gutta-percha, and mangrove bark. Although there is much excellent timber, it is hard to get out even close to the rivers, and will not be exploited to a great extent until the more accessible regions are exhausted.

New Guinea

If we may assume the same proportion of land area in forest as is estimated for British New Guinea (about 80 per cent), the forest area of Dutch New Guinea is about 77,824,000 acres. It is a dense tropical mountain forest of many species, except that along the coast are pure belts of mangroves, while slightly inland are open eucalyptus groves. The forests of New Guinea have not yet been exploited, nor have they ever been explored to any extent. The population is estimated at 400,000, of whom very few are Europeans.

Celebes

Much of the country, especially around the Gulf of Tolo, is covered with primeval forests and thickets. The forest area is estimated at 12,330,000 acres, or 27 per cent of the total land area. Vegetation is extremely rich, but there are fewer large trees than in the other islands of the archipelago. Bamboo and rattan-palm are common in the woods, and among the large trees are sandalwood, ebony, sapan and teak. The products of the forests supply about half of the total exports. The population is about 3 million.

The Forestry Movement in Netherlands East Indies.—The forests of Java have been under forest administration for more than 70 years. Forestry there has reached a much higher stage of development than in the Outlying Possessions, where until a few years ago no actual forest control existed and where even at present it is still in the experimental stage.

In Java there is a forest service, the duties of which include regulation of forest boundaries, surveying and mapping of the forests, preparation of working plans, reforestation of cleared tracts, forest protection, and supervision of the forest experiment station. Until recently the management of the government rubber plantations was also under the direction of the forest service, but since 1919 the state rubber industry has been a separate branch of the service. The forest experiment station was established in 1913, and its staff includes a technical forest director and several assistants. Within the last six years the experiment station has been greatly developed. The activities are confined chiefly to research regarding the location, composition, and condition of the forests, and to some regulation of cuttings. The cutting of forests is granted to private individuals on long terms. Forest areas not over 8,768 acres in extent may be leased for 30 years on payment of a fixed yearly rental and a tax per unit of wood cut. The concession may be withdrawn if exploitation is not begun within a year after acceptance. Besides long-term grants there are also concessions for cutting on short terms.

Most of the cutting in the Outlying Possessions is done on short terms. A considerable part of the wood is used in Java. Singapore also is an important wood market. The markets in China, Japan, and Australia are now being developed. A large part of the exported timber is supplied by species belonging to the dipterocarp family. Besides the exportation of ordinary timber, there are also being exported ebony, sandalwood, and speckled wood. Aside from timber, the forests in the Outlying Possessions are of great importance on account of the vast quantities of forest by-products. These by-products are gathered by the native population, and yield a direct revenue only in the form of export duty. The most important are rattan, damar, copal, gutta-percha, and tanbark. This export now amounts to about $400,000 per annum, while the value of the by-products themselves is estimated at 8 to 10 million dollars.

The growth of the forest administration may be inferred from a comparison of the number of employees in the Dutch East Indies in 1910 and 1918:

	1910	1918
Chief inspector	1	1
Inspectors and director of experiment station	5	9
Foresters, assistant and adjunct foresters of the first class	74	106
Adjunct foresters of the second class	10	...
Chief overseers, overseers, and student overseers	155	337
Native guards—forest police	268	494
Forest watchmen	424	774
Total	937	1,721

The net revenues are as follows:

1900—$376,800 1908—$854,400 1913—$926,800

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FRENCH INDO-CHINA

The Region as a Whole

Forest Area.—French Indo-China includes the protectorates of Annam, Tongking, Cambodia, the colony of Cochin-China, and part of the Laos country. In 1900 the newly acquired territory of Kwang-Chow Bay on the coast of China was also included as a part of the French administration of Indo-China. The total land area is estimated at about 185,600,000 acres (290,000 square miles), and the population at 17,000,000. The total forest area is estimated at about 62,000,000 acres, or 33.4 per cent of the total land area. By protectorates and colonies the distribution of forests is about as shown in Table 203.

Cochin-China, Annam, Cambodia, and lower and central Laos are particularly rich in tree growth, while northern Laos and Tongking are less heavily forested.

The forests of Indo-China, principally of Tongking, northern Laos, and Cochin-China, have been cut over for centuries by the natives. They are now under the process of restoration by the French Forest Department.

TABLE 203.—DISTRIBUTION OF FORESTS

Protectorate or colony	Total land area	Population	Forested area		Forested area per capita
			Acres	Per cent of land area	
	acres				*acres*
Tongking	29,440,000	6,000,000	8,645,000	29.4	1.4
Annam	33,280,000	6,124,000	14,820,000	44.5	2.4
Cambodia	41,600,000	1,500,000	9,880,000	23.8	6.6
Laos	67,200,000	550,000	23,469,000[1]	34.9	42.7
Cochin-China	14,080,000	3,000,000	5,186,000	36.8	1.7
Total	185,600,000	17,174,000	62,000,000	33.4	3.6

[1] Estimated.

Character of Ownership.—Practically the entire forest area of Indo-China is under state ownership, and controlled by the forest administrations of the several protectorates and colonies. Some forests are declared reserved forests in which cuttings are more strictly regulated; the rest are classed as unreserved with fewer restrictions as to cutting. The total reserved forest area is 3,388,000 acres, distributed by protectorates as follows:

	Acres
Cochin-China (147 reserves)	833,924
Annam (28 reserves)	670,360
Cambodia	1,192,153
Tongking	691,600
Total	3,388,037

The reserved forests are constantly being increased in size, but not all are under management. Thus only 179,473 acres out of the 833,924 in Cochin-China, and about 123,500 acres out of the 691,600 in Tongking, are actually under forest management.

Annual Cut.—The total production for 1916, including both sawlog estimate places the present average annual yield for the forests of Tongking at about 25 cubic feet per acre. For the entire reserved forest area of Indo-China this would make an average annual yield of about 85 million cubic feet. If this applied to the entire forest area (62 million acres), the annual growth would amount to over a billion and a half cubic feet a year. This is probably too high an estimate.

Annual Cut.—The total production for 1916, including both sawlog timber and firewood, amounted to 40,142,000 cubic feet. Of this 14,140,000, or 35 per cent, was sawlog timber and 26,002,000 cubic feet, or 65 per cent, firewood. The average cut per acre for the reserved forests is 11.8 cubic feet, for the entire forest area 0.6 cubic foot, and the cut per capita is 2.3 cubic feet. This evidently does not include a large amount of cordwood and bamboos cut by the natives for which no official record exists. Probably not less than 30 million cubic feet of bamboos are utilized annually. The entire cut must be at least 50 million cubic feet and, judging by the wood consumption in Malaysia where conditions are similar to those of Indo-China, possibly much larger.

The woods are divided into four classes or groups, and the price per cubic meter of log or squared timber is fixed for each species of the class.

1. Woods of the first class are of fine grain and high specific gravity, take a good polish, and are resistant to insects and decay. These woods are generally used for high-grade cabinet work.
2. Woods of the second class are also of high grade, but are not as dense as those of the first class. Though suitable for most uses, they are commonly employed for carpentry and joining. Most of them are resistant to insects and rot.
3. The third class includes woods inferior in quality to those of the first and second classes. Their chief use is for boxes and cheap furniture.
4. The fourth class includes woods suitable only for fuel. It also includes a very large number of soft, non-resinous woods, which could probably be used for the manufacture of pulp and paper.

By protectorates and colonies the cut for 1916 was distributed as shown in Table 204.

TABLE 204.—TIMBER CUT, FRENCH INDO-CHINA, 1916

Protectorate or colony	Sawtimber		Firewood		Total	Cut per capita
	cu. ft.	*p. ct.*	*cu. ft.*	*p. ct.*	*cu. ft.*	*cu. ft.*
Annam	2,499,000	40	3,675,000	60	6,174,000	1.0
Cambodia	5,164,000	51	4,905,000	49	10,069,000	6.7
Cochin-China	2,726,000	18	12,802,000	82	15,528,000	5.2
Laos	500,000[1]	45	600,000[1]	55	1,100,000[2]	2.0[3]
Tongking	3,251,000	45	4,020,000	55	7,271,000	1.2
Total	14,140,000	35	26,002,000	65	40,142,000	2.3

[1] Estimated. [2] Calculated from[3]. [3] Assumed.

Loss.—The loss due to forest fires, clearing of forest land, and decay must be enormous. Judging by the fact that shortages of timber of better grades are already felt in Tongking and Cochin-China, it would seem that the loss is nearly if not quite as large as the actual annual cut, or about 50 million cubic feet.

Annual Consumption.—The cut of 50 million cubic feet of all kinds of wood, together with about 30 million cubic feet of bamboos, or a total of 80 million cubic feet, represents the yearly domestic consumption of Indo-China. The total per capita consumption is thus about 5 cubic feet.

It is evident that little wood is used locally except for fuel and boat building. The natives use bamboo for houses in rural districts, while in towns stone and tile are preferred to wood. Where wood is used, native hardwoods, on account of their ant-resistant qualities, are preferred to imported woods. Whatever the imports of coniferous softwoods may be, they are chiefly used in Indo-China by the French government in its navy yard and dock yard in Saigon. Pine is used for furniture and interior work aboard ships, and to a smaller extent in the construction and repair of small boats.

Exports and Imports.—Although the forests of Indo-China include many timber trees which would be of great commercial value, as well as many other trees which could find a place in the industries of Europe, export of timber from Indo-China to France and to other European countries is practically non-existent, being limited to a few cabinet woods destined for very special uses. Other forest products exported are rubber, sticklac, gutta-percha, gums, turpentine, rosin, benzoin, kapok, and rattan. There is considerable trade, however, between the different protectorates and colonies. Thus 70 per cent of the annual timber production in Cambodia is exported to Cochin-China, chiefly through Sadec, Vinhlong, Mytho, and Cholon. Similarly, Tongking, which in 1916 exported 183,242 cubic feet of timber of all kinds and forms to Hongkong, imported 450,000 cubic feet of lim logs from Annam. Tongking is thus dependent upon Annam for lim wood.

Exports of teak from Saigon (the only port from which it is exported) in 1913 amounted to about 52,950,000 cubic feet or 636,500,000 board feet. Nearly all of this teak, however, originated in Siam and not in Indo-China. The teak exported from Saigon went to the following countries:

	M board feet	
Hongkong	386,447	(probably mostly reexported)
France	130,034	
British India	67,458	
Europe (except France)	38,957	
Singapore	13,636	
Total	636,532	

Imports for the five-year period 1910–14 averaged 1,346,000 board feet per year, valued at $58,780. About half of it was Douglas fir from the United States.

Ports.—The principal port of entry of Cochin-China is Saigon. It is the only harbor where vessels can enter with safety and where they can be quickly loaded and unloaded. Haifong is the port for all Tongking; Tourane is the chief port of Annam. About 16 sawmills are operated in Indo-China. There are also scores of Chinese yards where the native timbers are whipsawed by the Chinese sawyers.

Probable Future.—There are many obstacles in the way of developing an export trade from Indo-China: (1) lack of knowledge of properties of the woods; (2) high transportation charges; (3) difficulty and costliness of logging; (4) wide fluctuations in the monetary unit (piastre) of the Indo-China protectorates, which is not stabilized and therefore makes all merchandise, both imported and local, unusually high. The high prices at the shipping ports and the cost of freight will long be prohibitive to the exportation of heavy timber into Europe or France. On the other hand, it is likely that a moderate amount of lighter woods suitable for telegraph poles, mine timbers, packing boxes, tool handles, spools, matches, toys, canes, and the like can be exported. There is also a large supply of by-products, such as bamboo, rattan, oils, and resins, which could be profitably exported.

The possibilities of export trade are indicated in the estimates of the several administrative forest officers of the protectorates. Thus the chief of the Forest Service of Cambodia estimated that the province can furnish 28,240,000 cubic feet of timber annually without impoverishing its forests. According to its forest authorities, Annam, including the pine forests of Lang Bian, could furnish more than 3,530,000 cubic feet of timber a year. If all the coniferous forests of Annam were exploited they could furnish, it is claimed, at least 17,650,000 cubic feet of wood a year. The chief of the Forest Service of Cochin-China estimates that the forests of that colony could supply 1,164,900 cubic feet of wood a year. Lower and Central Laos, although no figures are available, could furnish at least as much as Annam, or 3,350,000 cubic feet. The forests of Tongking are too nearly exhausted even to meet local needs. Thus Indo-China could produce annually about 36,464,900 cubic feet of timber for export trade. The use of timber of both precious and common kinds from Indo-China, at least by France, will gradually grow. Even before the war the use of colonial woods had begun to assume considerable proportions. During the war Indo-China furnished banglang for gunstocks. As the properties of the colonial woods become better known and exploitation and transport are cheapened while the supply of temperate hardwoods diminishes, they are certain to appear in increasing quantities on the markets of Europe.

Tongking

Area and Character of the Forest.—The forest area of Tongking is placed at 8,645,000 acres. This is merely an estimate, as no accurate statistics are available. The forests on the whole are very much depleted, bare mountains covering vast areas. The virgin forests have been devastated, some of them centuries ago, and the remainder since occupation by the French. The 8,645,000 acres of land designated by the name of forests includes much deforested land which is not capable of restoring itself without artificial reseeding or planting, a task which is not being undertaken at the present time. Moreover, a large number of rice plantations and forest parcels used by the natives for the purpose of obtaining by-products are also included. The reserved forest area is about 691,600 acres, and the area under actual management is 123,500 acres. The latter area is managed chiefly for fuel under a system of coppice with standards. The trees are for the most part broad-leafed, mixed here and there with conifers in certain regions. Pure stands or stands of only a few species are rare; as many as 50 different species may be found on a single acre. The forests have almost entirely lost their original character, as the natives have been devastating them for centuries. Primeval forests are found only at high elevations, 2,300 to 4,900 feet and more above sea level. The forests in the valleys and plains are badly devastated and consist of inferior, undesirable species. Even the second growth has disappeared on vast areas, giving place to brush or grassy savannahs. The primeval forests must formerly have covered all of the lower regions of Tongking, but they have been destroyed to make room for field crops. Tropical species, such as the *Dipterocarpeae, Sterculiaceae,* and *Anonaceae,* are represented only in small numbers. There are a number of species of the temperate region, such as oak, maple, chestnut, ash, magnolia, walnut, and others. There are both hard and soft species, the latter prevailing in the forest growth that followed fires, cutting, or clearing. The greater part of the trees are much shorter than those of the typical tropical forests.

The regimen of streams in Tongking has suffered from the effects of deforestation. Beds of rivers are clogged with sand banks and rocks. The action of torrents is evident not only on mountain sides but also in cultivated valleys. Sand, gravel, and even heavy rocks are carried along by the rushing water, and form deposits of detritus which destroy the rice plantations of the upper valleys.

Annual Cut.—The cut in 1916 according to the different classes of woods was as follows:

Table 205.—Amount of Wood Cut in Tongking by Classes (1916)

Class	Quantity
	cu. ft.
Class 1	151,000
Class 2	562,000
Class 3	2,538,000
Fuelwood	4,020,000
Total	7,271,000

Judging from the amounts cut in 1916 the following species are the most commonly used:

Woods largely of first and second class

	cu. ft. (logs)
Gie Soi } Oak (*Quercus*)	122,950 68,800
Cho—*Dipterocarpus*	69,400
Tau—*Vatica*	61,175
Goi—*Amvora* (wood of third class)	55,880

Woods of third and fourth class

All these species are of slight value—characteristic woods of cut-over and culled forests devastated by man; they are not suitable for permanent construction.

	cu. ft. (logs)
Muong—*Cassia timoriensis* and other leguminous softwoods	442,944
Cham or Tram—*Canarium*—several species	394,619
Bode—*Anthostyrax*	309,334
Xoan—*Melia* and several other genera	280,317
Vang—*Mallotus* and several other genera	185,360

Cambodia

Area and Character of the Forest.—The estimated forest area of 9,880,000 acres does not include the forests inundated at high water nor those near villages which will be cleared to make room for field crops in the near future. The forests are divided into three distinct groups—inundated forests, second-growth forests, and dense forests in dry situations.

The inundated forests contain only inferior species mingled with vines and rattans. Like the forests near the villages they are certain to disappear before long, since the rich soil on which they grow is in demand for agriculture. As it is impossible to supervise them efficiently and exploit them methodically, they are entirely neglected by the forest administration of the protectorate.

Of the second-growth forests the principal species are: phchek, sokram (*Rubiaceae*), thbeng, trach, and khlong (*Dipterocarpeae*), growing isolated without undergrowth. From August to November the soil is covered with young seedlings and sprouts coming up among the grass; by January, the beginning of the dry season, the young plants and grasses are destroyed by fires lighted by the natives. These fires injure the soil, destroy the young plants, and hurt the larger trees or kill them altogether; hence natural reproduction is difficult.

The dense forests on the drier situations are located in the districts of Stung-Treng, Kratie, Kompong-Thom, Kampot, and Battambang. They contain over 1,100 species of more or less well-known trees, utilized to a greater or less extent in local industry. The species rarely occur in pure stands, but are mixed in such a way that it is often possible to count more than 100 on a fairly small area. The stands located along the principal rivers have been cut over by the natives without method. Many stands a few miles from floatable streams are still almost intact, however, and contain considerable material which could be exploited by opening roads and altering the courses of the streams.

The forests of Cambodia contain species suitable for many industrial uses, such as cabinet and furniture making, vehicles, building, railroad ties, and mine timbers. Some of them are also suitable as substitutes for the woods of France as well as those of America, Sweden, and Russia. The by-products are important and varied, including resins, gutta-percha, barks, dyewoods, tanning extracts, medicinal plants, odoriferous woods, textile and fibre plants, bamboos, rattan, etc.

Forest Management.—The reserved forest area is now about 1,192,000 acres. All forests of Cambodia are under administration. No cutting may be done without license, except to a certain extent in unreserved forests. Classified species may not be cut smaller than specified dimensions; felled timber must be hauled directly to the depot and the license verified. Fuel cutting is also regulated by license. By-products are not subject to conditions of exploitation, but can not be exported from their original province without payment of a tax, about 10 per cent ad valorem. The Forest Department is carrying out a program of improvements in the forests, such as construction of roads and straightening out of streams to make them floatable. When the entire program is completed the dense stands covering more than 494,000 acres between Khong and Stung-Treng will be opened up to utilization. Wood commerce has grown greatly in this region in the last few years. The export from Stung-Treng in 1916 was 5,965 pieces, the volume of which was 393,136 cubic feet. These works of improvement not only facilitate the utilization of the forests of the region of Stung-Treng, but are also of great service to the Company of East French Asia, which cuts in Siam and floats on the Mekong four to six thousand teak logs per year. These are sawed at Saigon and exported to Europe.

Reforestation also is carried on in the reserved forests. The principal object is to propagate the species which are most in demand in commerce, as well as bamboo, a very necessary product now becoming scarce.

Clearing of forests by burning for the purpose of using the land for agriculture is common in the province. It is impossible to check the practice suddenly, since the natives depend on it as a means of livelihood. It will be necessary to proceed gradually, introducing improved methods and implements.

Other fires, which are of yearly occurrence, also do great damage. They break out in the dry season, spread rapidly, destroy the forest growth, and consume the humus. These fires are usually lighted deliberately, either to renew pasturage or merely from custom, rarely from malice.

Annual Cut.—The amount of building timber cut in 1902 was only 3,056,768 cubic feet; in 1910 it reached 3,584,433 cubic feet, and in 1915, 6,014,873 cubic feet. It is conservatively estimated that 28,240,000 cubic feet can be exported each year. Thirty per cent of the annual production is used in Cambodia, and 70 per cent exported to Cochin-China, chiefly to Sadec, Vinhlong, Mytho, and Cholon. The cut of fuel wood was 3,248,000 cubic feet in 1911 and 4,936,000 cubic feet in 1915. The growth of the lumber industry may be gathered from Table 206.

TABLE 206.—TIMBER CUT IN CAMBODIA, 1907–1916

Year	Timber	Fuelwood	Bamboo	Total
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*
1907	2,708,000	2,696,000	89,000	5,493,000
1908	3,554,000	3,112,000	402,000	7,068,000
1909	4,432,000	2,733,000	272,000	7,437,000
1910	3,584,000	3,225,000	701,000	7,510,000
1911	3,852,000	3,248,000	84,000	7,184,000
1912	3,973,000	3,532,000	199,000	7,704,000
1913	5,362,000	4,129,000	214,000	9,705,000
1914	6,694,000	3,171,000	934,000	10,799,000
1915	6,015,000	4,936,000	1,756,000	12,707,000
1916	5,164,000	4,905,000	1,380,000	11,449,000
Average	4,533,800	3,568,700	603,100	8,705,600

Owing to the condition of the streams and the distance between centers of exploitation and the floatable rivers, it is only during the months of September, October, and November that heavy timber can reach the principal markets of Mekong and Tonle-Sap. Four fifths of the timber is sold on the ground to buyers from Cochin-China. The value of products exploited in 1916 was as follows:

Building timber	$1,491,981
Fuel	184,574
By-products	294,599
Charcoal	34,181

These figures do not include products delivered free of charge to the Cambodian population, the value of which is more than $1,737,000.

Species Suitable for Export.—The following woods of Cambodia are considered suitable for export trade:

Table 207.—Cambodian Woods Suitable for Use in France

Name	Description	Amount available for export per year	Uses
		cu. ft.	
Chhoeuteal (*Dipterocarpeæ*) (Known in France as Cambodian oak)	Common in Cambodia. Reaches 59 inches in diameter. Wood strong, easy to turn and saw.	1,765,000	Carpentry, ordinary furniture, vehicles, etc., and all uses under shelter.
Khlong, thbeng (*Dipterocarpeæ*)		176,000	Same.
Sralao (*Lagerstroemia*)	Widespread. Large dimensions, long fibers. Saws and bends easily.	706,000	Furniture, joining, vehicles, oars, gunstocks.
Koki (*Dipterocarpeæ*)	Very large.	353,000	Carpentry, furniture, vehicles, boats, crossties.
Phchek (*Dipterocarpeæ*)	A very heavy, hard wood, small sizes, resistant to moisture.	353,000	Good for supporting timbers of bridges and houses, heavy carpentry, and vehicles. Also good for railway timbers, telegraph posts, etc.
Reang-phnom (*Dipterocarpeæ*)	Very hard, brittle, and inflexible.	353,000	Same uses as phchek.
Sokram (*Rubiaceæ*)	Tough and hard, often called iron wood.	353,000	Bridge timbers, high-grade furniture, hubs and spokes of wheels, cross ties, etc.

TABLE 207.—CAMBODIAN WOODS SUITABLE FOR USE IN FRANCE—*Continued*

Name	Description	Amount available for export per year	Uses
		cu. ft.	
Lumbor (*Dipterocarpeœ*)	Large sizes, flexible but difficult to saw.	105,900 to 141,200	Furniture. Might also be used in the manufacture of airplanes.
Phdiec (*Dipterocarpeœ*)	Very large sizes. Wood light, works and turns easily.	353,000	Small carpentry timber, common furniture, vehicles, and especially coffins.
Beloi (*Lauraceœ*)	Very large. Wood light and works easily.	70,600 to 88,250	Carpentry and furniture.
Bosneak (*Clusiaceœ*)	Wood hard and resistant to insects.	17,650 to 21,180	Bridge timbers, columns for houses, railway ties, spokes of wheels. Could also be used for pulleys.
Kralanh	Large dimensions. Resistant to moisture.	14,120 to 17,650	Bridge timbers, house columns, railway ties.
Thnong	Large dimensions. Hardens with age. Polishes well.	21,180 to 28,240	Turning, carving, veneering, high-grade furniture.
Kroeul (*Rubiaceœ*)	Wood hard, brittle, works and polishes well.	35,300	Columns and ties.
Krakas (*Leguminosœ*)	Large sizes. Wood heavy, hard, inflex- and brittle. Resists moisture, turns and carves easily.	141,200 to 176,500	Columns, high grade furniture, and ties.
Beng (*Leguminosœ*)	Same as krakas.	35,300	Same as krakas.
Chramas (*Dipterocarpeœ*)	Tall, but small in diameter. Fine grain, hard.	35,300	Columns, railway ties, bridge timbers.
Kranhung (*Leguminosœ*)	Excellent wood, hard and heavy, but rather rare.	7,060	Much in demand for carving and veneer, fine furniture, spokes of wheels, and railway ties.
Neang-nuon	High-grade wood, heavy and hard. Rare.	7,060	Turning, veneer, carving, fine furniture, hubs and spokes of wheels.

Export Trade.—The woods of Cambodia have not as yet figured largely in European commerce. If their properties were fully known in the home market they would be considerably in demand, since a great many of them are suited to use in the mother country (France). Table 207 gives some of the woods which are adapted to use in France.

By-Products.—Very few of the secondary forest products have been exported up to the present time. The local commerce amounts to over $289,500. It is estimated that more than half of the by-products, such as resins, gums, and barks, go to waste because their uses are unknown to natives and Europeans, and because the Cambodians do not harvest a third of the by-products with which they are familiar. The Forest Department has recently decided that all by-products of apparent commercial value shall be studied and analyzed with a view to their utilization, and that samples shall be sent to France.

Annam

Area and Character of the Forest.—The forest area is estimated to occupy nearly half the total area of the country, or about 15,000,000 acres. This is too low an estimate if the entire area covered by some kind of forest vegetation is considered; on the other hand, it is too high for the area of exploitable timber only. The forests of Annam form a continuation of those of Tongking to the north, Cochin-China to the south, and Laos to the west. They represent an enormous timber wealth comprising rare woods, such as rosewood, ebony, ivory wood, and some common timber suitable for pulp and paper and other uses.

Dipterocarps and Leguminous Species.—Among the broadleafed trees, the dipterocarp and legume families furnish the most valuable species. While the dipterocarps furnish timbers for heavy building, the legume family furnishes fine cabinet woods and building timbers, as well as wood suitable for turning and decorative purposes.

Conifers.—There are also many species of conifers, pines especially, covering hundreds of thousands of acres, but most of them are located in remote regions difficult of access. Although they could be exploited, transportation and logging would be too costly for this to be profitable under present economic conditions. The country has no roads and but few inhabitants. In addition to the pines, *Chamaecyparis, Thujopsis, Cunninghamia,* and *Taxus* are found. The coniferous forests occur in both pure and mixed stands. The pure stands in general are subject to wind, fire, and disease.

The Pine Forests of Lang-Bian.—The province of Lang-Bian contains large pine forests, the possible annual production of which has been estimated from 14,120,000 to 21,180,000 cubic feet, capable of yielding large quantities of pulp, as well as saw-timber. These forests are not accessible at present.

Annual Cut.—The cut for five years, 1912 to 1916, of sawlog timber of the several classes and of fuelwood is given in Table 208.

Table 208.—Annual Timber Cut by Kinds of Wood, 1912–1916

Year	1st class	2nd class	3rd class	Not classified	Total	Per cent	Firewood	Per cent	Grand total
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*		*cu. ft.*		*cu. ft.*
1912	....	....	....	....	1,860,000	33.1	3,754,000	66.9	5,614,000
1913	....	....	....	....	2,603,000	31.5	5,658,000	68.5	8,261,000
1914	228,000	838,000	423,000	984,000	2,473,000	34.2	4,762,000	65.8	7,235,000
1915	480,000	380,000	343,000	687,000	1,890,000	43.5	2,455,000	56.5	4,345,000
1916	935,000	257,000	435,000	872,000	2,499,000	40.5	3,675,000	59.5	6,174,000

Waste and Fires.—A great amount of wood is wasted in the forests of South Annam; heavy timber trees usually grow large at the base, making cutting slow and difficult, hence woodcutters saw trees off at 5 to 7 feet above ground, and waste from 35 to 70 cubic feet of wood from each tree. When the tree is down the cutters take out a log of a certain length and the remainder is wasted. Much damage is also done to young growth in removing heavy logs from the forests; "there are as many roads in these forests as there are trees cut and hauled out." Logs are hauled by buffalo. Woodcutters also burn much wood uselessly; on a burned-over area of 50 acres there is often as much as 7,000 cubic feet of half-burned lim, completely useless. There is a similar waste in cutting firewood, since, as a rule, the smaller trees are cut for fuel.

Most of the burning of the forests of Annam is done under the name of clearing. This is a process of cultivation which consists in burning several thousand acres of forest every year, followed by planting field crops on a few hundred acres. Although in theory the process is supposed to follow a sort of cycle, on different areas, coming back to the starting point when the forest has restored itself, this does not work out in practice. The forest does not restore itself; it is followed by grass which is burned regularly every year. This practice can hardly be suppressed among the tribes in the mountain regions, but it could be checked to a great extent in the plains, where the natives are in closer contact with civilization. Every year fire destroys fine stands completely. Unless strenuous measures are taken to prevent such destruction the forest of North Annam, between the plain and Laos, will disappear wholly in less than half a century. Some of the colonists recently asked the Forest Service to intervene for the purpose of checking forest fires. During a single year the inhabitants of a village composed of 30 huts almost completely destroyed the forest within a radius of 15.5 miles.

There are immense devastated areas in certain regions, separated by wooded tracts, though the latter are decreasing year by year. The bamboo forests are also destroyed by fire. These fires are due quite as much to carelessness and neglect on the part of the authorities as to actual wrongdoing, and perhaps even more so, since those who do the burning are usually ignorant of the evil consequences and merely continue a practice which had been carried on long before their time. The best remedy seems to be to place the responsibility for the fires on the villages, and to require the inhabitants to devote a certain number of days, in proportion to the extent of the destroyed forest area, to the work of reforestation.

The usual effects of deforestation are evident in this region—gradual increase of the area of uncultivated land at the base of the mountains, due to the washing down of debris from the bare mountain sides, filling up to the beds of streams, and consequent floods.

Principal Exporting Centers.—Haifong, Ben-Thuy, Tourane (port of Central Annam), Quinhon, Bangoi, and Saigon, are the most important exporting centers.

By-Products.—The forests of Annam yield many by-products such as bamboos, rattans, oil, resin, gums, tanbark, fiber, medicinal extracts, oil-producing seed, cardamom, and vines, which in the aggregate bring considerable revenue.

Forest Administration.—The forests are managed under the law of August 26, 1914, modified by laws of September 30, 1915, and April 14, 1916. Woods and forests located in the territory of Annam belong either to forests reserved by decree of the Governor General or to protected forests, which include all other forests under supervision. The protected forests are further divided into classified and unclassified. Classified forests contain four kinds: precious woods, and woods of the first, second, and third class. No wood may be cut in the protected forests without a cutting permit; trees of classified species less than 17.7 inches in diameter breast high may not be cut; and classified trees must not be converted into fuel. The minimum cutting diameter of unclassified woods is 5.6 inches.

Resin tapping is carried on in the reserves of Hoang-Mai, in Lang-Bian, and at Dang-Kia. The results are on the whole not satisfactory, owing to the difficulty of procuring material and labor. Forest roads have been opened by the Forest Department for hauling and as boundaries; they also sometimes serve as fire protection trenches.

Reforestation.—For several years the Forest Department has been undertaking works of reforestation in places where the plantations can be protected from fire, in uncultivated regions, near the official headquarters of forest officials where proper supervision is available, or on the seashore, where work of fixing dunes is in progress. The main object of planting is to provide fuel wood. The results of the work are in general encouraging.

Species Suitable for Export Trade.—The following woods of North Annam possess qualities that make them suitable for export trade:

TABLE 209.—WOODS SUITABLE FOR EXPORT

North Annam

Wood	Qualities and Uses
Bong-hoi	Joining.
Bop	Cabinet making. Very light and easy to work.
Bui	Cabinet making.
Bung	Carpentry and furniture.
Caoi (*Quercus.*)	Uses not given. Splits and warps easily.
Chau	Easy to work; very resistant; not attacked by insects. Joining, cabinet making, and vehicles.
Chec	Not resistant to extremes of temperature and not attacked by insects when protected from moisture. Columns.
Cho-chi	Very good flexible wood. Carpentry and small boats.
Choi (*Dipterocarpus tonkinensis*) (Ivory wood).	A very handsome and perfect cabinet wood. Resistant to insects.
Chua	Would be excellent if heart were developed. Carpentry, joining, and furniture making.
Chua-khet	Very good building timber; durable and ant-resistant. Suitable for all uses.
Chua-nao	Good wood. Carpentry.
Chuong-van *Laurineæ*)	Rare. One of the best woods of Annam. Suitable for all uses.
Gie. Several varieties. (*Quercus castanea, Castanopsis.* etc.)	Wood flexible, large sizes. Suitable for all uses.
Goi. (*Aglaia* or *Amoora* or *Epicharis* of the *Meliaceæ*).	Wood flexible. Gunstocks.
Gioi. (*Sindora. Leguminosæ*)	Large size. Carpentry and joining.
Go	Same uses as some French woods—boxes, tool handles, wooden shoes, etc.
Gu or Go. (*Sindora. Leguminosæ.*)	Much in demand for all uses in native building; resists moisture and insects. Good for camp beds.
Hoang-ling. (*Baryxylum. Leguminosæ.*)	Good wood, but very brittle.

TABLE 209.—WOODS SUITABLE FOR EXPORT—*Continued*

North Annam

Wood	Qualities and uses
Hue-moc. Rosewood. (*Laurineæ* and *Leguminosæ*.)	Most beautiful wood of Annam; much used for furniture; rare.
Lim. (*Erythrophleum. Leguminosæ*.)	Very hard wood, resistant to rupture, weather, and insects. All uses. Exported in large quantities to Hongkong.
Loi	Joining and furniture making.
Mat	Hard wood. Carpentry and marquetry.
Mang	Fine grain, easy to work but warps easily. Cabinet work.
Mit. Two var. (*Artocarpus. Moraceæ*).	Excellent wood; easy to carve, resistant. Furniture making.
Muong. Ebony. (*Diospyros. Ebenaceæ*.)	Valuable. Hard to work; cannot be nailed until pierced. Used for tables, chairs, panels, beds, etc.
Re	Ordinary quality; large size. Low-grade planks.
Roi	Very good, flexible. Columns, carpentry, and wagon shafts.
Sang	Rather large dimensions. Resistant to insects, durable, light. Cabinet and furniture work; also gunstocks.
Sang-le, or bang-lang. (*Lagerstræmia. Lythrarieæ*.)	Excellent, light, flexible, large sizes. In great demand for furniture and oars and all uses under shelter. Large stands on border of Laos, near Cua-Rao, but difficult to exploit.
Sen. (*Shorea. Dipterocarpeæ*)	Good wood. Suitable for all uses, especially vehicles.
Tau	Several species not of same family; (one *Gleditschia*, other *Dipterocarpus*) (*Vatica*).
Thong. (*Pinus*)	Like pines of France; inaccessible.
Tram. (*Canarium. Myrtaceæ*.)	Hard, used for cabinet work and building.
Vang-Tam	Fairly light and very resistant. Furniture and building.
Vang. (*Mallotus*.)	Wood of mediocre quality.
Vap. (*Mesua ferrea. Guttiferæ*.)	First class wood; small sizes. Piles and railway ties.
Xoan-Dao	Light, fine grain. Furniture and building.
Xu	Ordinary wood. Cheap boards.
Xoan. Japanese lilac. (*Melia azedarach* L. *Meliaceæ*).	Resists insects and decay well. Columns of houses, joining.

TABLE 209.—WOODS SUITABLE FOR EXPORT—*Continued*

Central Annam

Wood	Qualities and uses
Boi-loi. (*Tetranthera. Laurineæ.*)	Light wood; works easily, resists insects; brittle. Carpentry, joining, furniture, carriage making, coffins.
Cho. (*Pistacia* sp. *Anacardiaceæ.*)	Very good carpentry wood. Furniture, sea-going junks.
Cong	A light, resistant wood. Building, furniture, and junk masts.
Chua	Joining, carpentry. Has too much sapwood.
Chuon	Carpentry and masts.
Dau. (*Dipterocarpeæ*)	Produces oils and resins used in making torches and varnishes.
Gie	Many varieties. Good wood suitable for all uses.
Gio. (*Aquillaria agallocha. Thymeleaceæ.*)	Paper.
Gioi. (*Sindora*)	Large sizes. Carpentry and joining.
Go. (*Sindora*)	Handsome wood. Carpentry, columns and pillars, fine furniture, carving, camp beds, and hubs of carriages.
Goi. (*Aglaia*)	(See woods of North Annam.)
Hoang-ling. (*Baryxylum*)	Building. Very brittle wood.
Hue-moc. Rosewood	Valuable. High-grade furniture, carving, pipes, paneling. Cutting is restricted.
Huynh. (*Sterculiaceæ*)	Light, works easily. Cabinet-making. Not very resistant to moisture and insects.
Kien-kien. (*Dipterocarpeæ*)	Good wood for many uses—building, junks, furniture and masts. Ant-resistant.
Leo-heo	Good wood. Resistant to insects. Cheap furniture, pigeon-hole sets, etc.
Lim. (*Leguminosæ*)	Very good wood. Heavy building timbers, bridge timbers, columns, and railway ties.
Mit vuong and mit nui. (*Moraceæ.*)	Very good, does not warp. Columns, high-grade furniture, and fine carving.
Mung	Good wood. Cabinet work and carpentry.
Mun or Muong. (Ebony)	Valuable wood. Same uses as that for North Annam.
Muong. Partridge wood. (*Leguminosæ.*)	Not the same as the above. Handsome wood used for furniture.
Ngau	Soft wood. Resistant to insects. Hut building and small carpentry timber.
Sen. (*Shorea. Dipterocarpeæ.*)	Good wood, easy to work and does not warp or crack. Resists insects. Fine furniture and joining work.
Son. Mahogany (*Anacardiaceæ.*)	Light wood. Building and vehicles.

Table 209.—Woods Suitable for Export—*Continued*

Central Annam

Wood	Qualities and uses
Tau	An excellent hard wood. Resists insects and lasts for centuries. Building. Large sizes.
Ten	Light joining work.
Tram	Good, except tram-coi variety.
Truong. (*Sapindaceæ*)	Very hard, difficult to work, does not crack, and resists insects. Building.
Uoi or Hoenh-Nai. (*Sterculiaceæ.*)	Good only for cheapest kind of work.

South Annam

Wood	Qualities and uses
Bang lang. (*Lythrarieæ*)	Resembles ash. Good for all work requiring elasticity.
Binh-linh. (*Vitex. Verbenaceæ.*)	Good wood. Works easily, and is much used for vehicles.
Boi-loi. (*Laurineæ*)	Same as that of Central Annam. Coffins.
Cam	Fair quality. Can be used only under shelter.
Cam-lien. (*Peltophorum. Leguminosæ.*)	Hard wood. Good for turning, columns, inlaid work made by natives with mother of pearl.
Cam-xe. (*Xylia. Leguminosæ*)	Resistant to decay. All kinds of building.
Cho. (*Dipterocarpeæ*)	Building, small boats, and furniture.
Cong	Light, resistant wood. Building and furniture.
Dang-Huong. Red Sandal. (*Pterocarpus. Leguminosæ.*)	Becomes hard with age. Works well and resists heat and moisture. High-grade wood work.
Dau. (*Dipterocarpeæ*)	Many varieties, good wood. Durable under shelter.
Go. (*Leguminosæ*)	Several varieties. Always resists insects. Suitable for all kinds of uses—columns, camp beds, furniture, etc.
Huynh. (*Sterculiaceæ*)	Fairly light wood, easily worked. Furniture, vehicles, etc.
Muong. Ebony	Flexible and hard. Perfect black color. Fine furniture.
Muong. (*Leguminosæ.*) Partridge wood, bois de perdrix.	Furniture. Not the same as Muong, ebony.
Sangda. (*Dipterocarpeæ*)	Furniture and carpentry in native houses.
Sao. (*Dipterocarpeæ*)	One of the best and most resistant woods. Very large sizes; substitute for oak for most uses. Not very resistant to liquids. Suitable for all uses.
Son. Mahogany. (*Anacardiaceæ.*)	Good wood. Not resistant to weather. Interior house timbers and furniture.
Thong. Pine	Like pines of France; durable but mostly inaccessible. House timber.

TABLE 209.—WOODS SUITABLE FOR EXPORT—*Continued*

South Annam

Wood	Qualities and uses
Trac. Violet ebony. (*Dalbergia. Leguminosæ.*)	Cabinet wood.
Ven-ven. (*Anisoptera. Dipterocarpus.*)	Fairly light wood, resistant to insects and weather. Coffins, etc.
Xoai. Wild mango. (*Anacardiaceæ.*)	Many uses, such as for camp beds, mortars for pounding rice to remove the husk, etc., but not much employed in building because of high price.

Lang-Bian

Bach-tung	Very good wood, having similar qualities to pine.
Cho-xet	Good wood, not yet identified. Similar to bo-bo, a variety of sao.
Dau-long. (*Dipterocarpeæ*)	Good construction wood, but not resistant to weather. Trees reach large dimensions and produce oil.
Dung	Wood of ordinary quality, esteemed by natives because it is easy to work. Not decorative.
Sen. (*Dipterocarpeæ*)	Good light wood. Much in demand for vehicles, building, and many other uses.
Son-ghe	Light wood. Building.
Thong (Pine)	Very good building wood; durable.

Cochin-China

Area and Character of the Forests.—For thirty centuries the forests of Cochin-China have been devastated. First the savage and semi-savage peoples who in turn occupied the land destroyed them without discrimination. After that the Annamite people, in spite of a more advanced civilization, always regarded the forest as capable of renewing itself indefinitely and never thought of protecting it. In spite of unusually favorable conditions for growth, therefore, the forests had no opportunity to reestablish themselves after prolonged periods of destruction. At the time of the French occupation the forests of the Annamite territory were practically exhausted. As a result the one extensive forest area of Cochin-China now consists largely of cleared or brush land.

The forests may be divided into two distinct zones, the east or high, dry zone, and the west or flooded, marshy zone. Between these two regions is still another central zone including the provinces of Cholon, Tanan, Mytho, Gocong, Bentre, Travinh, Soctrang, Gantho, Binhlong, Sadec, and Longxuyen. While these provinces are almost entirely given over to rice growing or are covered with swamps, there are scattered groups of trees belonging to private owners or to villages, which still furnish considerable quantities of firewood. These clumps of trees are doomed to destruction, since they furnish an easy source of revenue to the peasant during the frequent hours of leisure from his field labor. It would be far better for the rice crops if the small stands of timber could be maintained, since they assure climatic protection to the growing rice.

The High Zone.—The forests of this zone cover the provinces of Tayninh, Thudaumot, Bienhoa, and the greater part of the province of Baria, extending northward into the forests of Binh-Thuan and Cambodia. The forests vary greatly in appearance, but give the general impression of having been devastated for centuries. With the exception of some hardwoods along the eastern and northern frontiers, there are found everywhere more recent stands containing inferior species, of little value, which took possession of the soil after the primitive forest was destroyed. The species composing these stands are many; there are no stands consisting of a single species. The stands do not look like the forests of Europe, in which two or three species grow together in a given space. All the species grow pell-mell, mingled with vegetation of every sort—vines, shrubs, bamboos, etc., forming an impenetrable jungle. These are obstacles to exploitation unknown in Europe.

Within this zone must be included the islets scattered through the gulf of Siam and the China Sea—about 150—all of which are wooded, and also the isolated mountain forests of low altitude in the provinces of Chaudoc, Longxuyen, and Hatien, which emerge like islands from the basin formed by the swamps of the west. While these stands include all the species found in the forests of the eastern provinces, the proportions are not the same, and the dimensions of the individual trees are usually smaller. Hence they differ slightly in composition and aspect from the eastern forests. The area of this scattered portion is about 345,800 acres, and it has been exploited to the limit at all times. Certain species, especially those used for vine props and for building and repairing Chinese boats, have become very rare; but for various reasons fire has been less prevalent than in the east, so that a few regions have been spared.

The Flooded Zone.—The forests of this zone extend throughout the region included between western Vaico and the Gulf of Siam, containing many cultivated portions, swamps, and a few low mountains covered with trees identical with those of the east. From the administrative point of view, the flooded forests are distributed among the provinces of Baclieu, Rachgia, Hatien, Soctrang, Chaudoc, Giadinh, and Baria, but it is hardly possible to estimate the actual area. Part of this immense territory is covered with salt water, either permanently from the daily tides, or intermittently at the period of high tide or during the equinoxes. The salinity of the water decreases with the distance from the coast region, however, and finally disappears almost entirely. This difference in salinity has a determining effect upon the nature of the stands. As a matter of fact, two different zones can be distinguished in the flooded forests, (1) that of the mangroves, and (2) that of the cajeput (*tram*). Mangroves require salt water; cajeput grows in fresh water, but can endure a slight degree of salinity. These forests are distinct from those of the east in that they consist entirely or almost entirely of a single species.

Mangrove Forests.—Mangroves (*Rhizophoraceæ*), several varieties of which are found in Cochin-China, are fond of land near the sea or near great rivers which empty into the sea and receive tide water directly. Toward the interior of the country their diameters and heights decrease. They become mixed little by little with species which do not require salt water, and finally the latter prevail. Mangroves furnish fuel of the best quality, poles for fisheries, beams for houses, and a good grade of charcoal. The yield of this tree is high; it is remarkably well adapted to the environment in which it grows, and in which it fills a most important role. The roots are large, forming "props" around the trunk and giving the forest a characteristic and strange appearance, especially at low tide. These roots interlace and form a close-meshed network which keeps the alluvial soil from washing away. Mangroves thus strengthen the banks of streams, and prevent their beds from being filled with sand and their courses from being turned aside.

Although the forests of the west, like those of the east, have unfortunately been intensively exploited and even destroyed from time immemorial, it is certain that deforestation in the west has taken on disturbing proportions, especially in the last few years, owing to the growing demand for fuel wood. Originally the banks of the rivers were covered, far into the interior, with a curtain of mangroves which were protected by law from being cut less than 500 feet from the banks. These laws were abrogated and the mangroves were cut. Filling of the river beds with sand, constant shifting of sandbanks, and changes in the course of streams may all be attributed to the disappearance of the mangroves. These conditions make navigation difficult, and continual dredging at great expense is necessary.

While the mangrove forests which grew in the provinces of Baria, Bienhoa, and Giadinh are exhausted, those on the peninsula of Camau have an area of about 741,000 acres and can still be saved if prompt action is taken.

At the present time the villagers consider the forests which belong to the local domain as their property. They have installed a number of charcoal furnaces, and sell the product chiefly to the Chinese, who evidently try to get the largest possible profit without regard to the future. It is even said that sea-going Chinese boats from Singapore land at deserted points of the coast, cut down trees there, either to make charcoal or to get the bark, and depart with their cargo without being molested. At any rate, wood is wasted there at a frightful rate, not to mention the improper methods used in extracting tannin from bark. Processes of gathering bark, and especially processes of drying, should be improved. When dried slowly in the open air, as at present, the bark loses half of its tannin content, which is oxydized and turned into a red coloring matter insoluble in acids and particularly harmful in tanning. It seems comparatively easy to introduce more rational methods of drying. There is at present no task more urgent for the forestry department and more remunerative for the colony than proper supervision and methodical exploitation in the peninsula of Camau.

Cajeput Forests.—Like the forests of mangrove, those of cajeput (*Melaleuca cajaputi*) which make up the second zone of the flooded or swampy forests, are of prime importance from the standpoint of economy and of climate for the entire western region of Cochin-China. It has been said that the two zones, mangrove and cajeput, are separated by a fairly exact line of demarcation, determined by the degree of saltiness of the water, and that the stands are unmixed or nearly unmixed. *Cay-tram* (native name), considered hitherto as a *Eucalyptus*, has been recently identified by Inspector Chevalier as *Melaleuca cajaputi* of the family of the *Myrtaceæ*. This tree reproduces itself by seeds especially, but also by sprouts and by stump shoots. It yields excellent fuel wood and columns and piles, the latter called *cai-congs*, which are used in many kinds of foundation work required in the western part of Cochin-China. The forests of this species have been devastated more than the others, probably because of the ease with which it can be exploited and the many uses which it serves. Vast forest areas have been granted as agricultural concessions, but in general the beneficiaries of these concessions have been satisfied with cutting wood for commercial purposes, often without paying for the privilege. They then, either deliberately or because they had not enough capital, abandoned the deforested land without making any improvements. In this way large areas were robbed of their forests without profit to agriculture. What is still worse, after the forest vegetation disappeared, these lands became covered with brush, worthless for protection against washing and incapable of development into forest, since the seedlings as well as the stump shoots were weak and died for lack of sufficient shelter. In addition, the ground became covered with grass, which made the area liable to fires. Fires occurred every year and destroyed the young trees, which were insufficiently protected by a thin bark. These lands, thus lost to the forest, finally became unsuited to any kind of cultivation and were a real danger to the adjoining regions. And yet, in this region more than in any other, the interests of agriculture are intimately connected with the conservation of forests on certain areas. The success of the crops depends on it, as the cajeput forests insure climatic balance and stability of the seasons. The governors of the province have already pointed out the atmospheric disturbances which have occurred during the last few years, attributing them to the gradual disappearance of the forests.

Cajeput is claimed to have certain important sanitary properties. It absorbs the harmful germs of swamp fevers which develop in the soil where it grows. Nature provides a remedy with the disease in this case. From this point of view the cajeput is the most important wood which the colony possesses, and if pressing economic reasons did not oppose it, the Forest Department would urge that cutting be absolutely prohibited in the forests open to free utilization and authorized only in the reserved forests.

The Distribution of the Forests by Provinces.—By provinces the reserved and unreserved forest areas are distributed as shown in Table 210.

TABLE 210.—DISTRIBUTION OF FORESTS BY PROVINCES IN COCHIN-CHINA

Province	Reserved forest area	Unreserved forest area	Total forest area
	acres	*acres*	*acres*
Baria	64,138	444,600	508,738
Bienhoa	96,414	2,356,380	2,452,794
Tayninh	150,769	617,500	768,269
Thudaumot	153,007	370,500	523,507
Giadinh	42,647	25,935	68,582
Chaudoc	12,943	31,122	44,065
Rachgia	49,365	98,800	148,165
Baclieu	264,641	304,551	569,192
Hatien	....	63,479	63,479
Travinh	....	18,525	18,525
Bentre	....	12,350	12,350
Gocong	....	8,398	8,398
Others	....	....	0.000
Total	833,924	4,352,140	5,186,064

Annual Cut.—The cut by classes of wood for nine years from 1908 to 1916 is given in Table 211. The cut of sawtimber and firewood for 1916 by provinces is shown in Table 212.

TABLE 211.—TIMBER CUT OF COCHIN-CHINA BY CLASSES OF WOOD

Year	Sawlog timber					Fuelwood	Grand total
	First class	Second class	Third class	Not classified	Total		
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
1908	723,000	39,000	1,939,000	420,000	3,121,000	4,542,000	7,663,000
1909	685,000	82,000	2,285,000	387,000	3,439,000	4,875,000	8,314,000
1910	686,000	64,000	1,751,000	500,000	3,001,000	4,110,000	7,111,000
1911	466,000	54,000	1,764,000	326,000	2,610,000	5,271,000	7,881,000
1912	386,000	50,000	1,536,000	289,000	2,261,000	19,586,000	11,847,000
1913	452,000	32,000	1,410,000	366,000	2,260,000	10,766,000	13,026,000
1914	671,000	757,000	1,055,000	338,000	2,821,000	11,845,000	14,666,000
1915	558,000	930,000	1,279,000	314,000	3,081,000	12,084,000	15,165,000
1916	549,000	922,000	966,000	289,000	2,726,000	12,802,000	15,528,000
Average	575,111	325,555	1,553,889	358,778	2,813,333	8,431,222	11,244,555

TABLE 212.—CUT BY PROVINCES OF SAWLOG TIMBER AND FIREWOOD (COCHIN-CHINA, 1916)

Province	Sawtimber	Firewood	Wood granted free	Total
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*
Baria	209,000	783,000	12,000	1,004,000
Bienhoa	743,000	2,453,000	47,000	3,243,000
Tayninh	1,244,000	1,210,000	34,000	2,488,000
Thudaumot	47,000	1,187,000	37,000	1,271,000
Giadinh	142,000	2,584,000	...	2,726,000
Cholon	5,000	5,000	...	10,000
Tanan	3,000	2,000	...	5,000
Mytho	10,000	599,000	...	609,000
Bentre	...	7,000	...	7,000
Vinhlong	...	49,000	...	49,000
Chaudoc	18,000	723,000	2,000	743,000
Gantho	41,000	1,452,000	...	1,493,000
Longxuyen	6,000	228,000	...	234,000
Soctrang	1,000	47,000	...	48,000
Baclieu	175,000	544,000	...	719,000
Rachgia	82,000	929,000	19.000	1,030,000
Total	2,726,000	12,802,000	151,000	15,679,000

Principal Products.—Aside from precious or rare woods, such as ivory wood, ebony, and rosewood, the timber wealth of Cochin-China depends largely on two families represented by a large number of genera and species: *Leguminosæ* and *Dipterocarpeæ.* The latter are found everywhere in the mountain forests. The present growth owes its origin principally to winged seeds brought in by the wind. This accounts for the predominance of species with winged seeds over those with heavy seeds, which are unfavorable to dissemination and to reproduction. *Leguminosæ,* having heavy seeds, are scattered and becoming more and more scarce. All species of these two families yield excellent timber for building and joining.

There are also certain species of *Lythrarieæ* suitable for use in building airplanes, and useful varieties of *Sterculiaceæ, Laurineæ, Verbenaceæ* and *Guttiferæ.*

Timber operators have increasing difficulty in procuring building timbers. They are obliged to look for these woods in places remote from shipping points, since there are no longer any trees of suitable dimensions in the vicinity of streams and railways. The total amount of timber cut in 1916 was about 355,000 cubic feet less than in the preceding year. The volume of the two species most used in woods of the first and second categories, *sao* and *dau,* however, was considerably greater than that of the year 1915—nearly 35,300 cubic feet more of each species. There was a corresponding decrease in the number of pieces for this increase in volume, which shows that in view of the increasing scarcity of these species, operators are looking for large and old trees which were left hitherto because it was too difficult to remove them from the forest.

The total volume of fuel for 1916 was 12,802,000 cubic feet, or about 718,000 cubic feet more than for 1915. The figure for 1916 is far from showing the total production of fuelwood in Cochin-China, because a considerable part is not recorded in spite of all efforts to discover the fraud. This is due to lack of adequate European personnel and to the impossibility of efficient supervision. The total production is probably in the neighborhood of 16,308,600 cubic feet per year.

By-Products.—Cochin-China possesses, in addition to timber, large quantities of plants yielding by-products which are of real value.

Bamboo.—Bamboo takes first place among the secondary products. It is found everywhere in the forests of the east, where it is represented by many varieties, each one of which has its special uses. Bamboo is the "poor man's providence." It furnishes his bed, building material for his hut, and his cooking utensils. Light and graceful furniture is made from it, as well as vases, pots, plates, and ornaments of every kind. It is used for baskets, ladders, bridges, irrigation pipes, gutters, and so on. The sprouts are edible, and animals are fond of the young leaves and branches. It is a plant of universal utility. In addition to these local uses, bamboo is especially adapted to paper pulp manufacture, and it is probable that this industry will sooner or later be an important source of profit to dealers and to the Colony.

There are, however, certain kinds of bamboos which are veritable forest pests. They grow up immediately after burning or clearing, rapidly invade the neighboring forests, and choke the young shoots. It is almost impossible to get rid of them. In regular cuttings it is important to leave a cover sufficient to prevent these species from getting a foothold.

Rattan.—Several varieties of rattans are found in Cochin-China, some of them growing in tufts and others in single stalks starting from a bundle of roots or from a knot. Some varieties bear spines, others are entirely or partly free from them. Rattan is used to make all kinds of cordage and a large number of basketry and furniture articles. It is usually split lengthwise.

Other Plants.—The forests of Cochin-China contain several kinds of climbing plants, some of which furnish excellent cordage, while others supply textile products, dyes, and latex. There are palms, the leaves of which are used to cover huts, to make junk sails, hats, etc. There are also a large number of medicinal plants used in native pharmacopœia, but little is known of their uses and value.

Oleoresins.—These products from the *Dipterocarpeæ* family, which is very widely distributed in Cochin-China, deserve special mention. There are two principal kinds: resin, furnished particularly by *Hopea* and *Shorea;* and wood oil, supplied in larger or smaller quantities by the tree called *dau.*

Resins are exudations, either natural or accidental, caused apparently by the boring of insects or birds. They occur along the trunk, branches, and roots, and form friable stalactites, pale yellow or amber in color, of brilliant fracture, which are as much as 3 feet long and 6 inches in diameter. Woodcutters sometimes find a duct completely filled with resin; they attribute this phenomenon to a kind of bee, which they say is found only in these trees. Resin is collected by the natives without any special system. It is used for torches and for making cement for calking, and will probably be employed in making varnishes.

Wood oil is collected during the dry season. It is obtained by making hollows in the tree, about 3 feet above ground, with a hatchet. The oil runs out into these hollows. After the flow has stopped the hollows are filled with straw or twigs, which are set on fire to renew the flow. This method is primitive, and the use of fire can hardly be explained. It is difficult to determine the yield of a tree; the natives claim that a tree can be tapped at the age of 30 years and will continue to yield oil for 60 years. This is doubtful, but it is likely that a tree might yield a maximum of 66 pounds per year. The amount of oil from dipterocarp species produced in Cochin-China may be estimated at more than 2,200,000 pounds. The local use of this oil is limited to making torches, calking junks, and varnishing furniture. It would find many uses in France, such as the manufacture of varnish, glazings, and various other products. It is to be deplored that the frightful waste practiced by the natives has not yet been successfully checked. The value of the material wasted is in general double and triple that of the products taken from the forests.

Forest Management.—*Reforestation.*—The question of reforestation is one of the most complex and delicate in connection with the colonial forests, which have only recently become known. Plant biology, like animal biology, has imperious laws. Before undertaking artificial reforestation, it is necessary first of all to create or recreate the environment favorable to forest plant life in general and to take account of the special conditions required by such and such species. Knowledge of the forests of Cochin-China is still very meagre, because it has been impossible hitherto to undertake continuous and coordinated experiments.

The first works of reforestation of any importance were begun in 1898 and 1899 in the four forest provinces of Baria, Bienhoa, Tayninh, and Thudaumot. An attempt was made at first to introduce exotic species, principally teak, as well as *Hevea* and *Ficus elastica.* About 15 nurseries were established; 50,000 teak plants were taken from the nurseries and planted in the forest.

In view of the unsatisfactory results, and considering also the high price of nursery plants and the impossibility of supervising and directing artificial plantings because of lack of personnel, it has been decided to discontinue the nurseries altogether and to restrict the planting to broadcast sowing, which is an easy and cheap method. These measures are now being carried out. After each felling, broadcast sowings of valuable species are made, at a favorable season and in selected localities. The greater part of the seeds germinate, the young plants being in their natural environment and properly protected by the seed-bearing trees, and they usually develop normally. These seedings cover an area of more than 7,410 acres annually. The trees probably will not produce useful timber before they are 40 years old.

Cultural experiments, carried on in the arboretum of Trangbom, include studies in reforestation for each annual felling. The work was begun in 1913, and is therefore too recent to allow of definite conclusions.

Protective Measures against Fires.—While limiting regeneration measures for the time being to broadcast sowing, the Forest Service has made the greatest efforts to obtain more adequate protection against fraudulent cutting and especially against fires. If these two formidable enemies can be conquered it will be easier to solve the problem of regeneration, for the tropical forest is endowed by nature with a growing strength which insures its reproduction wherever it is protected against the depredations of man. All that is then necessary is to improve it by introducing valuable species. Unfortunately, this point has not yet been reached, and fire is the great calamity which menaces the life and the future of the forest in Cochin-China. Mention was made earlier of the burning methods used by some of the semi-savage tribes in growing rice. These methods must and can be eliminated. The semi-savage population of Cochin-China may be estimated at 40,000. At least half of these people are in contact with civilization, and the administration now has sufficient means of dealing with them.

Aside from burning done by the natives, violent fires break out every year in the forest, devouring thousands of acres of fine trees. They are more dangerous and numerous when the dry season is prolonged. The damage is incalculable, both in the public forest and in the reserves, where clearings which are about to close naturally are traversed by fire, and the work of regeneration patiently continued by nature for many years is rendered ineffectual in a few hours. In the province of Baria, for example, where fires are exceptionally severe because of high winds blowing from the sea, it is impossible to find a stand of any importance that has not been attacked by fire. Even in the forests of the west, which are flooded for the greater part of the year, fires break out and complete the work of devastation accomplished under the pretext of clearings on agricultural concessions.

The Forest Service has undertaken a regular campaign against fire, and each year, with the approach of the dry season, it organizes its means of defense. Continual rounds are made day and night by European and native agents to keep woodcutters from lighting fires in dangerous places. The Governor of Cochin-China reminds the province chiefs at this time of important instructions previously given on the subject of checking brush fires. Moreover, the Forest Service placards the forests wherever necessary in Chinese and dialect characters forbidding setting fire to dry grass. Although persons violating the regulations are subject to trial, as a rule the criminal can not be caught. These measures have certainly decreased the number of forest fires, but they have by no means entirely disappeared and the damage caused by them is still considerable.

Forest Administration.—A law enacted December 1, 1913, divides the forest domain into *free forest* and *reserved forest*, each managed by special methods. The reserves, surveyed and marked, are created by decree of the Governor-General, to be managed with a view to rational exploitation. This is done under the direct and constant supervision of forest agents, who mark the seed-bearing trees and standards to be left standing and the trees to be cut. Since 1901 great efforts have been made by the Forest Service to create and manage forest reserves. "Free cutting" has been recognized as disastrous. There are at present in Cochin-China 147 reserves, with a total area of 833,924 acres (4 reserves of mangrove in the province of Baclieu have not yet been surveyed). About 70 of these are being exploited and are giving satisfactory yields, while others have been left to restore themselves.

In the "free forests" exploitation is carried on by means of special cutting permits which fix the amount and duration of the cuttings. The use of fire as a means of exploitation or of clearing brush is absolutely forbidden.

No new clearing may be undertaken without being authorized by decree of the Governor-General. This authority is not granted except upon recommendation of the Forest Service. In the case of agricultural concessions in portions of the forest, the clearing must be done progressively and gradually and cultivation must follow immediately, not more than one-fifth of the area being cleared before being cultivated, under penalty of reversion of such uncultivated portions to the government.

The inhabitants of forest villages enjoy certain rights of usage in the unreserved forests located on the territory of their villages. In exchange for these privileges the villagers give labor on works of forest improvement (opening and maintenance of roads and canals, etc.), and they are also supposed to help in protecting and conserving the forests by every means at their disposal. In case of fire, the authorities may conscript the aid of the inhabitants in checking the fire, under penalty of temporary abrogation of the rights of usage.

Principal Timber Trees.—Among the more important kinds of timber found in Cochin-China are the following:

TABLE 213.—TIMBER TREES OF COCHIN-CHINA AND THEIR USES

Binh-linh. *Vitex* species. *Verbenaceae.* Has many uses. Works easily and takes fine polish. Much in demand, especially for parts of vehicles. Leaves used in making lotion to cure rheumatism.

Ca-chac. *Shorea. Dipterocarpeae.* Used in building and makes fine columns. Too heavy for carpentry, hubs of wheels, knees of ships, and railway ties. Might be used for pulleys.

Cam-lai. *Dalbergia robusta. Leguminosae.* Handsome cabinet and furniture wood; turns well, though very hard. Takes and retains a brilliant polish.

Cam-thi. *Diospyros siamensis. Ebenaceæ.* Much in demand for fine cabinet and furniture work. Used also in making ornaments. Turns and works easily.

Cam-xe. *Jonquiera fraxinifolia. Xylia dolobriformis. Leguminosæ.* Becomes very hard when dried. Used for building of all sorts, cabinet work, parts of vehicles, ship timbers, railway ties, etc.

TABLE 213.—TIMBER TREES OF COCHIN-CHINA AND THEIR USES—*Continued*

Da-da. Railway ties and ship timbers.

Dang-huong. *Pterocarpus indicus. Leguminosæ.* Works very easily, and is used for columns and joining work, furniture, and high-grade coffins. A fine ship timber, although it cracks quickly.

Go. *Leguminosæ.* Much in demand for many building purposes; it is not attacked by insects, and resists moisture well. Also employed in ship and boat building, but its most common use is for cabinet work because of working and carving qualities.

Huynh-duong. *Epicharis. Meliaceæ.* Works easily, used for turning in making furniture and ornaments and also for high-grade coffins.

Sao. *Hopea. Dipterocarpeae.* Much used in building and for railway ties, cabinet work, vehicles and boats. Bends easily and takes varnish readily.

Sen. *Shorea. Dipterocarpeae.* Building, carriage making, cabinet work, and boats.

Son. *Melanorrhoea. Rubiaceæ.* Used in building. Furnishes the best shellac of Cochin-China.

Trac-bong. *Dalbergia striata. Leguminosæ. Papilionaceæ.* Very much in demand; extremely hard but works easily. Good for turning and carving. Used for making ornaments and furniture.

Trai. *Nauclea* species. *Rubiaceæ.* Building and furniture, coffins, railway ties. Cutting forbidden in Cochin-China.

Vap. *Messua ferra. Clusiaceæ.* Building, piles, spokes of carriage wheels, furniture, pulleys, or other articles subjected to constant friction.

Xoay. *Dialium cochinchinense. Leguminosæ.* Becomes very hard when dry. Building, agricultural implements, and wagons. Resistant to rubbing or shock.

Caduoi. *Cyanodaphne. Laurineæ.* Columns, railway ties, stringers, carpentry, wagons. Resistant to moisture, insects and decay.

Chai. *Shorea rubiflora. Dipterocarpeae.* Building, furniture, and boats. Yields an oleoresin. Cutting forbidden in Cochin-China.

Chieu-lieu. *Terminalia. Combretaceæ.* Furniture, protected constructions. Bark used for tanning and dyeing. Wood little employed for building.

Cho. *Rassia. Sapotaceæ.* Columns, lath, stringers, rafters. Works easily and used in cabinet work and furniture. A good bending wood.

Dau. *Dipterocarpeae.* Used for building but has to be treated. Turns and works easily. Also used for furniture and portions of river boats.

Gao. *Nauclea orientalis. Rubiaceæ.* Furniture and cabinet work. Works, carves and bends well.

Lautau. *Vatica cochinchinensis. Dipterocarpeae.* Much used in building and for railway ties.

Lim. *Baryxylum rufum. Leguminosæ.* Very little used. Not resistant to insects.

Sang-dao. *Hopea. Dipterocarpeae.* Building, boats, and furniture.

Viet. *Rhizophora conjugata. Rhizophoraceæ.* Building (columns, rafters and piles).

Vung. *Careya arborea. Myrtaceæ.* Building, especially columns. Saws easily.

Bang-lang. *Lagerstroemia. Lythrarieæ.* Much appreciated for its flexibility. Used for oars, bent timbers of boats, portions of vehicles. Easily sawed into planks.

Boiloi. *Tetranthera. Laurineæ.* Carpentry, cabinet work, coffins, rafts, carriage bodies, etc.

Cong. *Calophyllum. Clusiaceæ.* Strong and relatively light. Building, columns and building timbers, and furniture.

Dangde. *Sorbus. Pommaceæ.* Turns and varnishes easily. Ornaments, naves of wheels, etc. Much used by Chinese in making combs.

Goi. *Amoora. Meliaceæ.* Fine furniture, ornaments and high-grade coffins.

TABLE 213.—TIMBER TREES OF COCHIN-CHINA AND THEIR USES—*Continued*

Hauphat.	*Cassyta filiformis.*	*Laurineæ.*	Very widespread. Bark used in Chinese medicines. Well adapted for making boxes.
Huynh.	*Engelhardtia.*	*Juglandaceæ.*	Light-weight wood of handsome color and works easily. Used for furniture, building and panels of carriages.
Lanhnganh.	*Cratoxylon formosum.*	*Hypericineæ.*	Used generally as fuel. As a carpentry timber it lasts a long time if protected from the weather.
Ram.	*Phillyrea indica.*	*Oleaceæ.*	Boxes and cheap furniture. Bark and leaves used for medicine.
Sang-ma.	*Hopea* species.	*Rhizophoraceæ.*	Works easily and turns readily; very durable. Columns and house timbers, piles and stringers for bridges, vehicles, and furniture.
Sang-mau.	*Carallia lucida.*	*Rhizophoraceæ.*	Spongy and decays very rapidly. Used in building only where protected.
Sau.	*Melia dubia.*	*Meliaceæ.*	Should not be exposed to weather. Used in building only for wainscoting.
Tram-sung.	*Eugenia michelu.*	*Myrtaceæ.*	Columns, piles and posts.
Ven-ven.	*Anisoptera.*	*Dipterocarpeae.*	Light weight and works easily. Building, parts of vehicles, parts of boats, coffins, furniture. Resin used in making galipot for calking boats.

Laos

Area and Character of Forest.—The forests of Laos are not under forest administration, and therefore no statistics are available as to area and cut. They are similar in character to those of Annam and Cochin-China. While there has been great devastation in northern Laos, in central and southern Laos there are still vast forests as yet little explored.

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BRITISH INDIA

Forest Area.—Exclusive of the Native States, the total forest area of British India and the percentage of the land area covered by forest are given in the following table:

TABLE 214.—FORESTS OF BRITISH INDIA

	Total land area	Agricultural land	Forest land	Other land
Acres	691,708,160	270,013,440	215,339,520	206,355,200
Per cent	100	39.1	31.1	29.8

The Native States, which occupy about one-fifth of the area of India, have approximately 44,800,000 acres of forest.

Character of the Forest.—Because of the great variety of climatic and topographic conditions, the character of the forest is very diversified. There are distinguished six forest zones, as follows:

1. Evergreen
2. Deciduous
3. Dry
4. Alpine or mountain
5. Tidal
6. Riparian

1. *Evergreen Forests.*—This zone is found on the west coast, in Assam, in Burma, and in the Andaman Islands. The forests are largely tropical and sub-tropical. While many of the trees attain a height of 200 feet, most of them are as yet of little value. The west coast forests occur on the slopes of the western Ghats and the lower slopes of the Nilgiri, Anamalai, and Cardamom hills in the Bombay and Madras presidencies. These slopes are exposed to the monsoon currents of the Arabian Sea and the annual rainfall exceeds 100 inches. The mean annual temperature is between 75.5° and 80° F., and the relative humidity does not fall below 70 per cent. The Assam evergreen forests cover large areas in the upper valley of the Brahmaputra, and to some extent in the valley of the Surma River. The evergreen forests in Burma occur throughout the coast districts. The evergreen forests in the Andaman Islands may properly be considered as a part of the Burmese evergreen forests. The typical species or genera common to all the evergreen forests are:

Calophyllum
Cinnamomum
Dysoxylum
Eugenia
Ficus
Garcinia
Mangifera
Mesua ferrea
Michelia champaca
Tetrameles nudiflora

2. *Deciduous Forests.*—This is the most common type of forest in the remainder of the Indian Peninsula and Burma, in the sub-Himalayan districts from the Punjab to Assam, and in the Gangetic plain. The annual rainfall averages about 45 inches; nine-tenths of the rain falls during the southwest monsoon. The mean temperature is about 80° F.

Teak (*Tectona grandis*) and sal (*Shorea robusta*) occur in this type of forest but have two distinct areas of distribution.

3. *Dry Forests.*—The dry forests occupy the plains of the Punjab. the western half of Rajputana, and Sind, where the rainfall is sufficient. The average annual rainfall is 15 inches. The temperature during the monsoon, when most of the rainfall occurs, is about 85° F.

4. *Alpine or Mountain Forests.*—These forests occur in the Himalayan Mountains and in the hills of the Northwest Frontier and Burma. The most valuable mountain forests are those of the western Himalayas, where deodar (*Cedrus deodara*) is found. The important species of the mountain forests and their approximate altitudinal distribution are:

	Feet
Pinus longifolia	2,000 to 5,000
Pinus excelsa and Cedrus deodara	5,000 to 8,000
Picea morinda and Abies webbiana	8,000 to 10,000
Quercus semecarpifolia	10,000 to 11,000
Betula utilis, rhododendrons, and junipers	12,000 to 13,000

This is the zone of conifers and temperate hardwoods such as maple, walnut, oak, and horse chestnut.

5. *Tidal Forests.*—The tidal forests occupy alluvial land on the sea coast and at the mouths of rivers, especially on the Burma coast and in the Sundarbans and the Andamans. Mangrove and *Casuarina* are the typical trees of these tidal forests.

6. *Riparian Forests.*—These forests occur on river bottoms as, for instance, on the Indus and its tributaries. Among the important species of this type of forest are:

Acacia arabica
Dalbergia sissoo
Populus euphratica
Tamarix

Character of Ownership.—The character of ownership is shown in Table 215.

Annual Growth.—The annual growth on the state forests dedicated to timber production, and they form the chief forest-producing area of British India, has been estimated at 15 cubic feet per acre, or for the entire area of 80,837,760 acres, 1,212,500,000 cubic feet.

Annual Cut.—The annual cut of British India is reported to be 174 million cubic feet of saw timber and 173 million cubic feet of firewood, or a total of 347 million cubic feet. With a population of 315 million this constitutes 1.1 cubic feet per head of population, an extremely low utilization. It evidently does not take into account the cut in the native Indian States and the utilization of bamboos. Considering that the per capita wood consumption in Indo-China, including bamboos, is close to 5 cubic feet, while that of the Malay Peninsula runs over 90 cubic feet, the per capita consumption in British India must be considerably larger than 1 cubic foot. With a per capita utilization of even 5 cubic feet, the total annual cut must be in excess of 1½ billion cubic feet.

Loss.—The loss from fire has been placed at 14 million cubic feet and that due to waste and decay at 21,500,000 cubic feet, or a total of 35,500,000 cubic feet. This makes 2.9 per cent of the total gross growth.

Exports and Imports.—In spite of the fact that the annual growth is nearly 3½ times the present reported cut, British India is a wood-importing country. The annual imports exceed the exports by 2,725,300 cubic feet. The average annual imports and exports for the five-year period from 1914-1919 are given in Table 216.

India is still undeveloped and industrially backward, and the existing forest resources have barely been touched. The present excess of imports over exports is due largely to the undeveloped utilization of the forests and partly to the importation of coniferous timber, which is more readily obtainable from foreign countries. With an increase in the cut of teak and other tropical timber, the export of these species will also increase. Although India will be able to supply large quantities of timber to the rest of the world and in this way may even balance its timber trade, it will be dependent upon importation for the more common coniferous woods.

TABLE 215.—DISTRIBUTION OF FOREST OWNERSHIP, BRITISH INDIA

Belonging to	Area	Ratio to total forest area
	acres	*per cent*
British government:		
Dedicated to timber production[3]	80,837,760	31.1
Other forest[3]	80,101,760	30.8
Total	160,939,520	61.9
Native Indian States	44,800,000	17.2
Corporate bodies[3]	5,120,000	2.0
Private individuals[3]	49,280,000[1]	18.9
Grand total	260,139,520[2]	100.0

[1] A large part probably scrub forest.

[2] Excludes a very large but not definitely ascertainable area of village communal forests or grazing lands, which yield a considerable part of the requirements of the rural population in small timber and firewood.

[3] Estimated.

TABLE 216.—EXPORTS AND IMPORTS

Kind of product	Exports		Imports		Net imports	
	Quantity	Value f.o.b.	Quantity	Value c.i.f.	Quantity	Value
	cu. ft.		*cu. ft.*		*cu. ft.*	
Railway ties (various)			744,750	$350,012	744,750	$350,012
Pine timber and deal			816,150	685,644	816,150	685,644
Jarrah timber			181,800	91,334	181,800	91,334
Teak timber	1,462,750	$1,843,777	1,079,700	1,066,046	−383,050	−777,731
Other timber	185,100	80,273	1,550,750	877,769	1,365,650	797,496
Grand totals	1,647,850	$1,924,050	4,373,150	$3,070,805	2,725,300	$1,146,755

Revenue.—The forest revenue during the past 50 years has shown a steady growth. Table 217 shows the financial results of forest administration in British India for several five-year periods between 1864 and 1919.

TABLE 217.—FOREST REVENUE, BRITISH INDIA

Five-year average	Average area under the control of the Forest Department	Expenditures		Net revenue per acre
		Total	Per acre	
	acres			
1864–69		$ 131,220		
1884–89	57,238,400	996,300	$0.02	$0.02
1904–09	151,848,320	1,973,160	0.01	0.02
1914–19	159,798,400	2,799,360	0.02	0.04

While the net revenue per acre has considerably increased, the expenditure per acre has remained about the same as it was 25 to 30 years ago.

Forest Industries.—The census report of India for 1913 shows 2.5 million people dependent on wood cutting and wood working, and 1.3 million people dependent on basket making. In addition, there is a forest personnel of about 75,000 with their dependents, and the labor used in tending plantations, fire protection, and so on, of about one man per thousand acres, or 160,000 people with their dependents, making 800,000. The census report gives 6,800,000 people as employed in forestry. This figure obviously includes part-time labor. It is safe to say that between 4½ and 5½ million people in British India are dependent on forestry and allied industries for their livelihood during the greater part of the year. There are at present 155 sawmills, utilizing 26 million cubic feet of timber and employing 14,000 people.

The Indian Pine Resin Industry.—Of the world's trade in rosin and turpentine, or naval stores, the United States of America produces about 80 per cent of the output, France comes second with some 15 per cent, and the rest of the world furnishes the remaining 5 per cent. The naval stores industry in British India began about a quarter of a century ago when the potentialities of the white pine belt along the foothills and the low slopes of the Himalayas in northwestern India were realized. From a small beginning in the United Provinces and later in the Punjab, the resin collection rose recently to 4,615 tons net, the operations covering 97,525 acres of forest and giving employment to at least 4,000 operators. So far the only pine which has been dealt with commercially is chir pine (*Pinus longifolia*). Chir pine covers some 960,000 acres in government forests and 1,152,000 acres in the Native States, while blue pine, Khasya pine and *Pinus merkusii* extend over some 128,000, 1,152,000, and 768,000 acres, respectively, all under the control of the government. All of these pines yield resin of good quality. These figures indicate the possibilities of the turpentine industry. Recent expert estimates place Indian production at 24,685,710 pounds of rosin and 800,000 gallons of turpentine a year 10 years hence, and ultimately at double those figures, that is 48,160,000 pounds of resin and 1,920,000 gallons of turpentine a year.

The Paper and Pulp Industry.—In 1904 there were 8 paper mills in British India and the Native States, with an output of 20,100 tons of paper annually. The daily average number of persons employed was 4,266. In 1918 the number of mills had increased to 9, the output to 31,362 tons, and the average number of operatives employed to 5,759. The present paper production in British India is not sufficient to meet the domestic needs. In 1918-1919 the imports of paper and paste boards, exclusive of note paper and envelopes, amounted to 21,638 tons. In prewar times not less than 13,250 tons of pulp were imported. The most important raw materials used in India at present are grasses, rags of poor quality, hemp, jute, gunny bags, waste paper, and old ropes. There are very few native timbers which fulfil the necessary conditions for the manufacture of paper. The few timbers that meet the conditions are not available for pulp, as the timber is required in the ordinary development of the country. The enormous available supplies of bamboos and elephant grasses are considered sufficient for the manufacture of paper and paste boards for all the domestic needs of British India. The supplies of raw materials even give hope that it may be possible in the future to export some pulp from India to the East.

The Match Industry.—India is almost entirely dependent for its supplies of matches on imports from other countries. The bulk of the matches comes from Japan, Sweden, and Norway, and before the war they were also imported from Austria-Hungary, Belgium, and Germany. The imports of matches in 1915-1916 amounted to nearly 18½ million gross boxes. Since 1915-1916 there has been a decline in the imports to 11 million gross boxes in 1918-1919. The Japanese have now practically captured the Indian trade at the expense of Sweden and Norway. The wood most commonly used in India for match making is simul or cotton tree (*Bombax malabaricum*). The most suitable species, however, are fir and spruce from the Himalayas. The match industry in British India is under a serious handicap because of the high cost of transporting the species suitable for matches. In order to supply India alone with matches it would require a sustained yield of 4 million cubic feet of timber annually. The high cost of logging the material suitable for matches, together with the extreme cheapness of the imported matches, will probably prevent the development of the match industry in India on a large scale.

The Forestry Movement.—Although a permanent forest policy was inaugurated by Lord Dalhousie in 1855, an organized forest department was not established until 1864. The management of state forests in British India is in the hands of the Indian Forest Service, which is divided into administrative branches as follows:

1. The Imperial Service, which is recruited and trained in England.
2. The Provincial Service, which is recruited and trained at the Imperial Forest College at Dehra Dun.
3. The Subordinate Service, comprising an executive staff of forest rangers and a staff of deputy rangers and forest guards. The personnel of the Subordinate Service is recruited in India, and the forest rangers are trained either at the Imperial Forest College at Dehra Dun or at the Provincial Forest Schools.

In 1894 the government of India classified its forests into four broad heads, namely:

1. Forests the preservation of which is essential on climatic or physical grounds. These are usually situated on hilly country, where forest growth is of vital importance in holding the water supply under control in certain areas in order to provide an even flow in the dry season.
2. Forests which afford a supply of valuable timbers for commercial purposes, such as the teak forests of Burma, the sal forests of northern and central India, and the deodar forests of the northwestern Himalayas.
3. Minor forests containing somewhat inferior kinds of timber and managed for the production of wood, pasturage, and other materials for

local consumption. These forests are of great importance and value in agricultural districts.

4. Pasture lands. These are not forests in the generally understood term but are grazing grounds managed by the forest department.

Among the activities of the forest department are fire protection, planting waste areas, and regeneration of natural forests.

Forest Protection.—Because of the inflammability of many types of forests and prolonged dry seasons, the fire problem is one of the most difficult dealt with by the forest department. The success which it has attained is shown in Table 218, which gives the area burned and the forest area under protection by five-year periods from 1894 to 1919.

TABLE 218.—AREAS BURNED AND COST OF FIRE PROTECTION, BRITISH INDIA

Years	Area burned	Area under protection	Cost of fire protection
	acres	*acres*	
1894–99		20,026,880	$96,602
1899–04	2,294,400	22,551,680	132,785
1904–09	1,745,920	27,671,680	159,102
1909–14	1,559,680	32,260,480	216,450
1914–19	1,386,240	30,801,920	Not yet available

Planting Waste Areas.—Up to 1919 the forest department had planted 247 square miles (158,000 acres).

Regeneration of Natural Forests.—Since 1872 the forest department has undertaken the preparation of systematic forest working plans. The progress of this work is shown in Table 219.

TABLE 219.—AREA UNDER WORKING PLANS, BRITISH INDIA

Year	Acres	Year	Acres
1889	1,340,800	1909	30,786,560
1894	4,962,560[1]	1914	34,512,640
1899	13,022,720[1]	1919	38,828,800
1904	21,555,200		

[1] Excluding Bombay and Madras.

The silvicultural methods applied are given in the following statement. It does not include the Bombay Presidency, for which figures are not available.

	Acres
Clear fellings	168,320
Shelterwood compartment system	353,280
Group system	60,800
Selection system with improvement fellings	10,184,960
Coppice system	645,760
Coppice with standards system	4,518,400
Improvement fellings	7,842,560
Unallotted	10,211,200
Total	33,985,280

The forests in Indian states, which are estimated at 44,800,000 acres, are mostly under the management of trained forest staffs. If not, the Indian government details trained forest officers of the Imperial and Provincial Service or arranges to train the states' nominees at the Forest College at Dehra Dun or at other forest schools. Over the 49,280,000 acres of privately owned timberlands there is no control or guidance, although the government willingly gives advice and assistance on request. There is, on the whole, little forest activity by corporate bodies or individual timber owners. Many Indian municipalities, especially in the hilly tracts, have their own forest lands and a number of them are managed under working plans prepared by trained foresters. Forest areas under the military department are also managed on the basis of working plans. The forests of private companies, especially those connected with tea, coffee, and indigo, and rubber concerns, are badly managed and are deteriorating; there is no control over them and no regular management.

Education, Research, and Experimental Work.—The principal forest educational center in India is at Dehra Dun in the United Provinces. The forest college trains forest rangers for government service as well as Indian states' students. About 30 men a year are trained. Dehra Dun also provides training for the Provincial Forest Service. There are schools for rangers in nearly every province. The first organized forest research began in 1906, when an institute was established at Dehra Dun. The Indian Forest Service publishes a monthly journal, *The Indian Forester*. The Indian Science Congress, which meets annually at various centers in India, has papers on forest subjects.

Probable Future.—The freight charges from British India to European ports will affect to a considerable degree the development of a large export trade in Indian timber. Freight charges from India to the United Kingdom at present are more than double those from Canada, nearly double those from British Columbia, and somewhat more than those from South America, but considerably less than those from western Australia. As a result of the comparative cost of freight, India can compete successfully with other countries with regard to shipments of high-class timbers. She can not, however, compete with Scandinavia, the United States, Canada, and other countries in so far as coniferous and other timbers of the cheaper grades are concerned. This precludes the possibility of successful export trade in Himalayan conifers and in a large class of timbers which are without sufficient merit to command attention in the European markets. The choice of timbers for export trade from British India is, therefore, narrowed down to those suitable for high-class decorative or structural work—furniture and various other purposes demanding woods with special properties. In this kind of timber British India has a large selection. Another factor which will influence the development of an export trade in Indian timber is the distance of the forests from the sea coast. As a general rule, the forests of the Himalayan or sub-Himalayan region, except possibly in Bengal and Assam, are so far from the coast that the long railway journey would render the cost of transfer prohibitive except in the case of especially valuable products, such as walnut burls. The amount available for export trade, furthermore, will depend upon the local demand. It must be realized that British India is still a backward country, feebly developed industrially. With the industrial development of the country the local demand for timber will greatly increase. For instance, in the United Provinces, which are highly developed industrially, there is little or no timber to spare for export after local demands have been satisfied. In the light of these considerations it would seem that the provinces which give most promise for the development of an export trade in timber are Burma, the Andaman Islands, the west coast of the Peninsula, and possibly to some extent Bengal and Assam. Burma promises the widest field. Similarly the forests of the Andamans will at no distant date provide many high-class timbers for export trade, since an extensive development scheme is now being put into operation. The Indian Forest Service has estimated that in Burma alone the amount of standing timber other than teak is over 29,200 million cubic feet, of which 5,500 million cubic feet consists of ironwood (pyinkado) (*Xylia dolabriformis*) and 1,150 million cubic feet of "in" (*Dipterocarpus tuberculatus*). Even allowing for the possible local demands and for the fact that a considerable proportion of this timber will be unsuitable for export, these figures indicate the great possibilities of Burma as an exporter of timber other than teak. The government has made efforts from time to time, by the offer of liberal terms, to induce timber firms to develop an export trade in timber other than teak. The results so far, however, have not been encouraging.

Principal Timber Trees.—There are more than 2,000 different species of forest trees in British India. The most important commercial timbers at present are:

The Himalayan silver firs (*Abies pindrow* and *A. webbiana*). The former occurs only in the Himalayas at 7,500–10,000 feet altitude, and the latter both in the eastern and the western Himalayas. Both have soft, white, not very durable wood, suitable for packing cases, shingles, wood pulp and, after impregnation, for railroad ties. *Abies webbiana,* together with spruce, *Picea morinda,* covers about 1,900,000 acres of merchantable forest in the northwestern Himalayas. The present output is only 35,000 tons a year, but the yield can be increased many times over when transportation facilities are improved.

Babul (*Acacia arabica*). A moderate to large tree of the drier parts of the plains, chiefly in Sind (on tracts irrigated by the Indus), the plains of the Punjab and United Provinces and the Indian Peninsula generally. Furnishes light wood of red to reddish brown in color, hard and durable. It is used for building, carts and carriages, wheels, agricultural implements, turnery, and many other purposes. It yields excellent fuel. Bark used for tanning, pods for cattle fodder and tanning; the tree also yields a gum. Present supplies are generally fully utilized.

Cutch (*Acacia catechu*). A moderate-sized to large tree, common in most of the drier parts of India and Burma; grows in pure stands along the sandy beds of streams in the sub-Himalayan region. Wood light or dark red, very hard and durable. It is used for house-posts, carts, boats, wheels, furniture, tool handles, and agricultural implements, and makes excellent fuel. Cutch and kath are obtained by boiling down chips of the heartwood. Supply largely utilized, especially in Burma.

Haldu (*Adina cordifolia*). A large tree found in mixed deciduous forests throughout the greater part of India and Burma. Wood yellow, moderately hard, durable, rather apt to warp and crack. Used for building, boats, furniture, agricultural implements, boxes, turnery, carving, toys, and other purposes. Has recently been used with considerable success for the manufacture of bobbins. Moderate supplies are available.

Siris or "Indian walnut" (*Albizzia lebbek*). A large tree growing wild in certain parts of the sub-Himalayan region, the Indian Peninsula, Burma, and the Andamans. Largely planted along roadsides and in gardens. Wood dark brown traversed by darker or lighter streaks, handsome, used for building, furniture, agricultural implements, wheels, carving, and turnery. The timber is available in considerable quantity in the Andamans where it is known by the Burmese name Kôkko. The "burrs" which are sometimes formed on the trees are especially valuable for veneers.

Cotton tree, simal (*Bombax malabaricum*). A very large tree, common throughout the greater part of India and Burma. Wood soft, whitish, perishable, used for packing cases, tea boxes, inferior planking, canoes, matches, well linings, toys, veneers, and other purposes where a soft wood is required. A similar wood of rather better quality is yielded by *B. insigne*, a very large tree of Burma, the Andamans, and the west coast of India. Present supplies in accessible localities are largely utilized, especially for tea chests in Bengal and Assam.

Poon-spar tree (*Calophyllum tomentosum*). A large, straight-stemmed, evergreen tree of the west coast. Wood reddish brown, used for masts and spars, house building, ship building, and construction generally. In fair demand in accessible localities.

Toon, red cedar, Moulmein cedar (*Cedrela toona*). A large tree found in various parts of India and Burma; often cultivated. Wood red, soft, handsome, fragrant, easily worked, and seasons quickly; used for furniture and cabinet work, doors, boxes, general carpentry, tea boxes, cigar boxes, boats, carving, and many other purposes. Resembles open-grained mahogany and is of high value. Generally fully utilized.

Deodar, Himalayan cedar (*Cedrus deodara*). A very large coniferous tree of the western Himalayas, most common between 6,000 and 8,000 feet. Wood yellowish brown, moderately hard, oily, strongly scented, and very durable. It is one of the most important timbers of India, and is largely used for railroad ties, building, carpentry, and construction of all kinds. The area of merchantable forest is approximately 1,280,000 acres. The yield, which is now 100,000 tons of timber a year, will gradually increase to double that quantity under intensive management.

Satinwood (*Chloroxylon swietenia*). A moderate-sized tree of the Indian Peninsula, furnishing the well-known satinwood of commerce. Wood hard, yellow, frequently with a beautiful wavy grain and satiny lustre. Satinwood is exported chiefly from Ceylon and to a lesser extent from India, where the trees are usually of small size, approaching fair dimensions in the south. Used for carving and ornamental work of all kinds. Available in fair quantity but small in size.

Blackwood, rosewood of Southern India, or shisham of the Indian Peninsula (*Dalbergia latifolia*). A large tree of central and southern India, extending north to the sub-Himalayan region in Oudh, where it is of small size. The well-known blackwood of commerce is furnished by this tree. Wood hard, handsome, dark purple, with black streaks. Used for furniture, door and window frames, panelling, carts, tool handles, and gun-carriage wheels. It is exported for furniture and ornamental work. Fully utilized wherever accessible.

The sissoo or shisham of Northern India (*Dalbergia sissoo*). A large tree of the sub-Himalayan region, chiefly in river bottoms, but extensively planted in other localities. Wood hard, strong, durable, brown with darker streaks. Used for building, furniture, cart and carriage frames, wheels of carts, carriages, gun-carriages, carving, and turning. Supplies increasing; fairly well utilized.

The "in" or "eng" tree of Burma (*Dipterocarpus tuberculatus*). A large tree growing in pure stands over extensive areas in Burma. Used especially for building, particularly in the form of boards and scantlings; used also for boats and carts. The wood has been exported to some extent to Europe under the name of "eng teak." Future yield is estimated at 50,000 tons a year.

Gurjan (*Dipterocarpus turbinatus*). A very large tree of Burma, the Andamans, Chittagong, and Cachar. Moderately hard, reddish brown wood, used for building boats. The timber has been exported in some quantity from the Andamans to Calcutta and Madras. There are large supplies available in the Andamans, and experiments are in progress to ascertain the possibility of employing the wood for railroad ties after antiseptic treatment. The tree yields a wood-oil known as gurjan oil.

Lampati (*Duabanga sonneratioides*). A large tree of Bengal, Assam, Chittagong, Burma, and the Andamans. Wood gray, often yellowish, and soft. Seasons well without splitting. Used largely for tea-boxes, canoes, and tea chests. Generally utilized.

Gumhar (*Gmelina arborea*). A moderate-sized or large tree scattered throughout the greater part of India and Burma. Wood grayish white, fairly soft, even grained; of good quality and seasons well. Used for furniture, doors, carriages, agricultural implements, boats, toys, and general carpentry. A valuable timber tree occurring sporadically and not in large quantities.

The *Grewias,* known indiscriminately as "dhamin" (*Grewia asiatica, G. tiliaefolia, G. vestita*). Wood tough and elastic. Used for shoulder poles, spear handles, bows and other purposes requiring elasticity. Not fully utilized.

Sundri (*Heritiera fomes*). A tree of the Sundarbans and other tidal regions, the coast of Arakan and Tenasserim and the Irrawaddy Delta. Wood dark red, hard, durable, strong, tough and elastic. Used for building, boats, masts, spars, shafts, wheels and furniture. Fully utilized in the Sundarbans, but large quantities available in Burma.

Thingan (*Hopea odorata*). A tall evergreen tree of Burma and the Andamans. Wood yellowish brown, hard, very durable. Used for house-building, bridge construction, piles, boats, wheels, carriage building and agricultural implements. One of the most valuable timbers of Burma.

Irumbogam, or ironwood of Malabar (*Hopea parviflora*). A large tree of the western Ghats from southern Kanara southward to Travancore and Tinnevelly. A valuable timber which is used to a considerable extent for house building, bridge construction, boats, wheels, carriages, and agricultural implements. Wood brown, hard, and durable. Large quantities available in localities which at present are more or less inaccessible, but which can be rendered accessible.

Walnut (*Juglans regia*). A large tree of the Himalayas at 3,000 to 10,000 feet; also found in the hills of Upper Burma. The true walnut of commerce, possessing a beautifully mottled brown wood with darker streaks. The "burrs" or burls are particularly valuable for veneers, and have been considerably worked in Kashmir and elsewhere. The wood is used for furniture, veneering, carving, and gunstocks. Fairly common in many of the Himalayan forest regions, but many localities in which it grows are remote, and extraction is often difficult at present. Extensively cultivated in the Himalayas for its fruit.

Jural (Bengal), pyinma (Burma) (*Lagerstroemia flos-reginae*). Large tree of Bengal, Assam, Burma, and the moister parts of the Indian Peninsula. Often cultivated for its handsome flowers. Wood light reddish gray, hard, and durable. Used for house building, bridge construction, boats, ship building, carts, agricultural implements, wheels, and furniture. One of the most important timbers of Burma. Available in fair quantity.

Benteak (*Lagerstroemia lanceolata*). A large tree of the western Ghats, extending southward to Travancore. Wood reddish brown, moderately hard, strong and durable. Used for house building, ship building, furniture, carts, and wheels. Available in fair quantity.

Nahor (*Mesua ferrea*). A large evergreen tree of Assam, Burma, the Andamans, western and southern India. Wood dark red, very hard, strong, and durable. Used for bridge and house construction, railroad ties, carts, boats, tool handles, and other purposes. Available in fair quantity.

Champ (*Michelia champaca*). A large tree of Sikkim, Bengal, Assam, Burma, western and southern India. Wood light olive-brown, soft, with a shiny lustre, and very durable. Used for panelling, furniture, carriage and boat building, carving, turning, and general carpentry. Fully utilized where accessible.

"Safed" champ (*Michelia excelsa*). A large tree of the eastern Himalayas at 5,000 to 8,000 feet. Wood olive-brown, soft, glossy, very durable. Used for door and window frames, furniture, carving and turning. Fully utilized.

Ingyin (*Pentacme suavis*). A large tree found throughout Burma, growing in the so-called "indaing" forest. Wood brown, hard, very strong, and durable. Used for house and bridge building, boats, carts, wheels, and agricultural implements. Fully utilized in accessible localities.

Himalayan spruce (*Picea morinda*). A tall tree occurring in the Himalayas at 7,000 to 11,000 feet. Wood white, sometimes reddish or brownish in the center in large trees, soft, and not very durable. Used for packing cases and general carpentry. On account of its long fibres it is also suitable for matches and wood pulp. It is available in large quantities in the Himalayan forests, but is not extensively utilized because of the high cost of extraction. (See *Abies pindrow.*)

Blue pine, kail (*Pinus excelsa*). A large tree of the Himalayas, occurring at 6,000 to 12,500 feet. Moderately hard, pink wood of good quality. Used for boat building, furniture, and general carpentry, and, after antiseptic treatment, for railroad ties. Quantities available at present are about 54,000 tons a year, the area of merchantable forest being 636,000 acres. The annual yield can be trebled under intensive management.

Long-needled pine, chir (*Pinus longifolia*). A large conifer of the Himalayas and the Siwalik hills at 1,500 to 7,500 feet. Wood light reddish brown, moderately hard. Used for building, common furniture, tea boxes, boats, general carpentry, and, after antiseptic treatment, for railroad ties. It is now extensively tapped in the United Provinces and the Punjab for the manufacture of resin and turpentine. The area of merchantable forest is about 1,728,000 acres, and the annual output of timber, which is now 85,000 tons, can be increased to three or four times as much.

Andaman padauk or redwood (*Pterocarpus dalbergioides*). A large tree of the Andamans, yielding a valuable, ornamental, moderately hard wood, deep rich red in color. Andaman padauk is largely used for house fittings, ornamental furniture, cabinet work, billiard tables, pianos, railroad car fittings, carving, and other ornamental work, as well as for wheels and boatbuilding. For some years this wood has been exported to Europe and America, and will be available in larger quantities in the future as forest industry develops in the Andamans.

Burma padauk (*Pterocarpus macrocarpus*). A large tree scattered in the mixed forests in several parts of Burma from Bhamo to Tenasserim. The wood, which is hard and very strong, is yellowish red to brick red, sometimes streaked with brown. Suitable for ordnance work of various kinds, such as gun-carriage wheels. In Burma it is extensively used for naves, spokes, and felloes of cart and carriage wheels, carriage building, shafts, and all purposes for which strength is required. Fully utilized in accessible localities.

Gum-kino tree, bijasal (*Pterocarpus marsupium*). A large tree of central and southern India, extending north to Oudh and the Kumaun Bhabar. Wood yellowish brown with darker streaks; very hard and durable. It is used for door and window frames, posts, beams, furniture, agricultural implements, wheels, carts, and boats. The tree yields, from wounds in the bark, a red astringent medical gum known as "kino." Fairly well utilized where accessible.

Red sanders (*Pterocarpus santalinus*). A small or moderate-sized tree occupying a limited region in the hills of the eastern Deccan. Wood dark purplish red, extremely hard, and valuable for wheels, shafts, agricultural implements, and particularly for carvings. Supply limited, but capable of expansion.

Oaks (*Quercus*). Nearly 40 species of oak in India and Burma, chiefly in the Himalayas, Khasia hills, Chittagong hills, and Burma. Several are of local importance for building and other purposes, but especially for fuel. While the timber is hard and durable, though difficult to season, none of them have proved to be of any special value for export or for general use outside their immediate regions. Large quantities available but not fully utilized.

Sandalwood (*Santalum album*). A small tree of the Indian Peninsula from the Nasik and Nagar districts southward, particularly in Mysore, Coorg, and some of the Madras districts. The heartwood is yellowish brown, hard, very close-grained, and strongly scented. Used for carving and fancy work of all kinds and is burned as incense. Sandalwood oil is distilled from it. Without exception, this is the most valuable wood in India. It is sold by weight, and every portion of the tree which yields heartwood of any size is utilized, the heartwood from the roots being the most valuable.

Thitya (Burmese) (*Shorea obtusa*). A large tree, common, chiefly in "indaing" forest, throughout Burma. Wood brown, very hard and durable; used for house and bridge construction, piles, carts, wheels, and agricultural implements. Fully utilized in accessible localities.

Sal (*Shorea robusta*). A large tree of northern and central India, in the sub-Himalayan region from Kangra to the Darrang and Nowgong districts of Assam, and in the Garo Hills, Chota Nagpur, Orissa, the Central Provinces, and the Ganjam district of Madras. Grows in pure stands. Wood brown, hard, and very durable. Used for building, bridge construction, piles, railroad ties, agricultural implements, railroad cars, ordnance work, and many other purposes. Sal is one of the most important timbers of India, owing its reputation to its great strength and durability. The timber is in great demand, particularly for railroad ties and building. The area of forest covered by this species has been estimated at over 4,000,000 acres and the annual output at over 180,000 tons. The species furnishes over 1,100,000 railroad ties a year, and some 5,500,000 cubic feet is utilized in construction work. Utilization of this timber is at present equal to the supply, but intensive forest management will increase supplies in the future.

Teak (*Tectona grandis*). A large tree of central and southern India, Bombay, and Burma. Wood yellowish brown, extremely durable, seasons well without warping or splitting, and works well. Teak is the most important timber of India, being superior to all other known woods for ship building, for which purpose it is largely exported to Europe. It is also used for building, furniture, cabinet work, panelling, carving, railroad cars, wagons, spokes and felloes of wheels, and agricultural implements. For export purposes the great bulk of the teak timber comes from Burma, where the trees do not ordinarily form pure forests of any extent but are scattered among a large number of other species. In Burma the timber is extracted by floating and the trees are girdled three years before felling in order to kill them and render the timber buoyant. The estimated amount of teak timber available annually is 280,000 tons, of which Burma supplies 225,000 tons. Fully utilized.

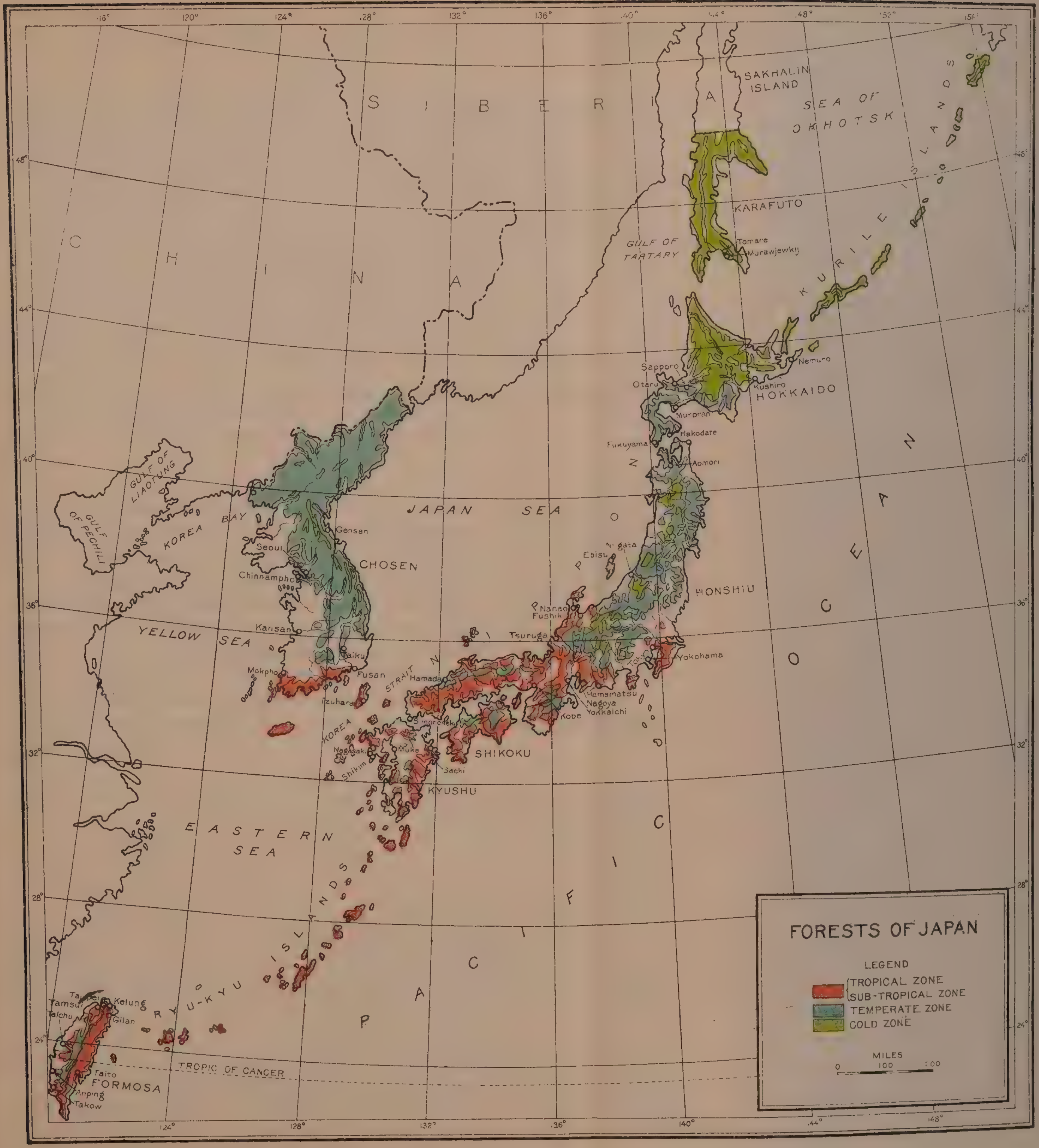
Myrobalan tree, harra (*Terminalia chebula*). A large tree, found throughout the greater part of India and Burma. Wood brownish gray with a small irregular dark purple heartwood, very hard; used for building, furniture, turnery, carts, naves and felloes of wheels, and agricultural implements. The tree is valuable chiefly for its fruits, which are the myrobalans of commerce and are largely used for tanning.

Arg, panisaj, hollock (*Terminalia myriocarpa*). A very large tree of of the eastern sub-Himalayan region and the outer hills of Assam and Upper Burma. Wood dark brown, handsome, hard; used for building, tea boxes, common furniture, boats, and cart shafts. After impregnation this timber may prove suitable for railroad ties. Large quantities are available.

Sain, saj, asan (*Terminalia tomentosa*). A large tree, common throughout India and Burma. Wood dark brown with darker streaks, hard, apt to split in seasoning, durability variable. It is used for building, rough furniture, oil mills, agricultural implements, carts, boats, mining timber, and other purposes. The timber is available in large quantities and, after impregnation, is likely to make good railroad ties.

Ironwood of Burma, pyinkado (*Xylia dolabriformis*). A very large tree, abundant in Burma. Wood reddish brown, extremely hard, heavy, very strong and durable. Used extensively for house and bridge construction, railroad ties, railroad trucks and cars, boats, carts, wheels, carriage frames, agricultural implements, and tool handles. After teak, this is the most important timber in Burma, where it is extensively used for railroad cars. It is very plentiful and obtainable in large sizes.

Jamba, irul (*Xylia xylocarpa*). A large tree of the Indian Peninsula from the Central Provinces and Bombay southwards. Wood reddish brown, very hard, heavy, durable, and apt to split in seasoning. Used for house and bridge building, agricultural implements, railroad ties, and other purposes. Available in fair quantity.



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JAPAN

Forest Area.—The forest area of Japan proper—Honshu, Shikoku, Kyushu, Hokkaido, and Riukiu (the Loochoos)—is about 46,600,000 acres, representing nearly 50 per cent of the entire area of the country. If to this be added the forests of Chosen (Korea), Japanese Saghalien (Karafuto), and Formosa (Taiwan), the total forest area of the Empire approximates 90,484,000 acres, or 53 per cent of the land area. This, however, is not all forest-producing land. Evidently it includes some waste land suitable in the main for forest growth, of which there is about 20,400,000 acres. The per capita forest area is 1.2 acres.

Table 220 summarizes the extent of the forests in the Japanese Empire.

Table 220.—Forest Area, Japan

Division	Total land area	Forest area	Ratio of forest to land area	Forest area per capita
	acres	*acres*	*per cent*	*acres*
Japan proper	97,293,427	46,602,185	47.9	0.8
Chosen (Korea)	54,910,225	29,375,395	53.5	1.8
Formosa (Taiwan)	9,036,625	7,156,780	79.2	2.0
Japanese Saghalien (Karafuto)	8,553,600	7,350,275	85.9	98.0
Total	169,793,877	90,484,635	53.3	1.2

The comparatively large proportion of forest land is due partly to the mountainous nature of the country which makes large tracts entirely unfit for cultivation, partly to the difficulty of transportation, and partly to the state policy of protecting forests (prohibiting forest devastation) and encouraging reforestation.

Character of Forest.—The larger part of the forests which are now being logged are natural forests. Some planted forests have reached merchantable size or are approaching that point.

The forests of Japan may be broadly divided into four zones:

1. *Tropical Zone.*—This zone covers the plains of Taiwan (Formosa), Ogasawara Island, and the southern half of Riukiu. The mean temperature is about 70° F. The representative trees are ako (*Ficus wightiana* var. *japonica*), and takonoki (*Pandanus odoratissimus* L.) Bamboos attain a perfect growth in this zone.

2. *Sub-tropical Zone.*—Forests in this zone are found in the northern half of Riukiu, the highlands of Taiwan, Shikoku, Kyushu, and the southern half of Honshu as far as latitude 35° N., the mean temperature ranging from 55° to 70° F. The representative trees in this zone may be divided into broad-leafed evergreens, conifers, and broad-leafed deciduous trees. In the first group are included kusu or camphor tree (*Cinnamomum camphora*), kashi (*Quercus abuta*), and shi-i (*Pasania cupidata*); in the second group several species of pines; and in the last group kunugi (*Quercus serrata*), and konara (*Quercus glandulifera*).

3. *Temperate Zone.*—The forests extend over the northern part of Honshu and as far as the southwestern section of Hokkaido corresponding to 43½° N. The mean temperature ranges from 41° to 55° F. The forests in this zone are the most important from an economic standpoint and are generally found in the mountain ranges that divide the main island—the Inner Japan section on the Japan Sea and the Outer Japan section on the Pacific. Among the conifers the most valuable are sugi (*Cryptomeria japonica* Don.), hinoki (*Chamaecyparis obtusa*), sawara (*Chamaecyparis pisifera*), hiba (*Thujopsis dolabrata*), tsuga (*Tsuga sieboldii*) and momi (*Abies firma*), and several species of pine. Among the valuable deciduous trees are keyaki (*Zelkowa serrata*), buna (*Fagus sylvatica* var. *sieboldii*), katsura (*Cercidiphyllum japonica*), several species of oak, chestnut, maple, magnolias, etc.

4. *Frigid Zone.*—The forests are found at elevations of 4,000 or 5,000 feet above sea level, in Honshu, the northeastern part of Hokkaido, and Chishima (Kurile Islands). The principal trees are shirabe (*Abies veitchii*), todomatsu (*Abies sachalinensis*), ezo-matsu (*Picea jezoensis*), shikotan-matsu (*Larix kurilensis*), chiefly on Saghalien Island, and lastly, hai-matsu (*Pinus pumila*), the procumbent pine that grows on the summits of high mountains in Honshu.

On the whole, trees grow unusually well in Japan because of the favorable climate and plentiful moisture. There are over a thousand species of trees, many of which yield excellent timber. Available estimates of the amount of standing timber of the most important species are given here:

Hinoki (*Chamaecyparis obtusa*) is the most valuable conifer of Japan. It is extensively planted for timber, reaching a height of 100 feet, 50 or 60 feet clear length, and a diameter of 3 feet at the base. The wood is used for building, high-grade interior finish, ship timbers, bridges, etc.

Sugi (*Cryptomeria japonica*). The amount available for industrial purposes has been officially estimated at 768 million cubic feet. Trees from 100 to 160 years old have diameters of from 1 to 2 feet and heights of over 100 feet. *Cryptomeria* wood is used for house building, bridge construction, and shipping, also for telegraph and telephone poles and for furniture.

Hiba (*Thujopsis dolabrata*). The amount of standing timber is estimated to be over 400 million cubic feet. The ages of the trees range from 100 to 150 years, the diameters up to 2 feet, and the heights from 60 to 90 feet. The wood is useful for many engineering purposes; it is impervious to water and has been known to last 80 years in construction under water.

Tsuga or hemlock (*Tsuga sieboldii*). The available quantity exceeds 332 million cubic feet. It usually occurs in mixture with fir, spruce, beech, and others. Mature trees are about 150 years in age, ranging in diameter from 1 to 2 feet and reaching a height of 70 feet. The wood is impervious to water. It is extensively used for building purposes, also for paper making, railway carriages, and packing boxes.

Momi (*Abies firma*). The estimated quantity of standing timber is 204 million cubic feet. Trees range in diameter up to 2 feet and reach a height of 90 feet. The wood is frequently suitable for boards and is extensively used for making tea chests. It is also employed in paper making.

Akamatsu (*Pinus densiflora*). The available quantity of standing timber is about 200 million cubic feet. The stands are from 70 to 140 years old. Individual trees reach a diameter of 4 feet and a height of 130 feet. The wood is a great favorite with the native population, and is used for building purposes.

Buna (*Fagus sylvatica*). Of the broad-leafed species the most important is buna. The available quantity is estimated at 3,400 million cubic feet. It is the most abundant of the Japanese forest trees. In many places it occurs in pure stands, 100 to 200 years old. Individual trees reach sizes of from 1½ to 2½ feet and heights of from 60 to 80 feet. The wood decays in water; its chief use is for fuel. When treated with chemicals it is occasionally used for railroad ties.

Mizunara (*Quercus grosseserrata*). The estimated quantity is 410 million cubic feet, mostly in mixed forest with walnut, magnolia, maple, chestnut, and others. The wood resembles chestnut but is somewhat harder. When dried it warps and splits easily, and though it can be obtained in large sizes it can not be sawed into planks. It is used for implements, utensils, ship construction and railroad ties.

Tochinoki (*Aesculus turbinata*). The available stand is 670 million cubic feet. The wood is not very extensively used, but because of its beautiful grain and lustrous color it can be lacquered for decorative purposes and is also used for carving.

Character of Ownership.—The forests are divided into three classes on the basis of usage: (1) protection forests; (2) utilization forests, and (3) percentage forests. The percentage forests are state forests left under the control of villages or towns which are entitled to a certain percentage of the products. They are gradually being converted into communal forests. By character of ownership the forests may be divided into state, crown, communal, and forests belonging to temples and shrines and to private individuals.

TABLE 221.—AREA OF FOREST ACCORDING TO OWNERSHIP (1915)

Owner	Acres	Per cent
Crown	3,224,161	7.06
State	17,957,640	39.32
Communal	7,011,040	15.35
Temple	269,346	0.59
Private	17,207,955	37.68
Total	45,670,142[1]	100.00

[1] This figure is slightly different from that in Table 220, being based on statistics for a different year.

The protection forests in 1917 occupied an area of 3,505,720 acres. Of this the crown owned 27,425 acres, the state 1,746,380 acres, communes 1,101,883 acres, temples 22,278 acres, and private individuals 607,754 acres.

Annual Growth, Cut, and Consumption.—It is estimated that the total annual forest growth of Japan averaged 2,540,000,000 cubic feet during the past 10 years. The total cut for all purposes during the same period averaged 2,255,620,000 cubic feet annually. The average annual export was 36,850,000 cubic feet against import averaging

1,230,000 cubic feet. This makes the amount actually consumed at home 2,220,000,000 cubic feet. The situation may be summarized as follows:

Table 222.—Summary of Annual Timber Cut, Growth, Trade, and Consumption

Item	Average annual cut	Average annual growth	Average annual export	Average annual import	Domestic consumption
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Total.....	2,255,620,000	2,540,000,000	36,850,000	1,230,000	2,220,000,000
Per acre...	24.9	28.1	0.4	0.01	24.5
Per capita.	28.9	32.5	0.5	0.02	28.4

Of the total cut of 2,255,620,000 cubic feet, 383,455,000 cubic feet (17 per cent) is sawlog timber and 1,872,165,000 cubic feet (83 per cent) is firewood and other minor products. On the whole, the cut of timber in Japan at present is slightly below the growth. There are, however, exceptions in many parts of the country. While in state forests the growth exceeds the cut, in private and communal forests the cut is, as a rule, greater than the growth. As a result, in some parts of the country there is already a shortage of certain kinds of woods; the supply of large dimensions used for ship building and other construction work has been nearly exhausted.

Exports and Imports.—Japan is now a lumber exporting country, the exports amounting to from 30 million to 40 million cubic feet annually, while imports total only about 1,200,000 cubic feet. The imports are confined chiefly to long and large timbers and certain hardwoods which are not found in the Japanese forests. The recent development of the match industry has caused a shortage in the local supply of match-stick material, and it has been found necessary to import large quantities of poplar from northern Manchuria and Siberia. The most commonly imported species are Oregon pine (Douglas fir) and cedar from North America, and such tropical woods as teak, mahogany, sandalwood, and ebony. Following the outbreak of the war, exports of timber and forest products decreased for a time but they soon began to increase with great rapidity. In 1918 the total had reached 6 times the volume of pre-war years. The principal export timbers are oak, ash, and "sen," used for railroad ties, tools, and furniture, and fir, hemlock, red pine, and spruce, used for making packing boxes. To these must be added materials for building, cabinet making, barrel and cask making, and bamboo manufactures. Prior to the war, square timber and railroad ties formed the greater part of the export. These were shipped chiefly to China, Europe, and Australia.

The total value of forest products exported during 1918 was $23,818,456, or an increase of $4,599,076 over that for the preceding year. The imports for the same year amounted in value to $3,892,565. Of the exports, timber formed the largest item, valued at $8,878,250. The rest consisted of charcoal, camphor oil, cocoa oil, and other by-products, as may be seen from Table 223.

Table 223.—Forest Products Exported, 1918

Timber	$8,878,250	Bamboo	$ 90,953
Charcoal	229,284	Shiitake	1,161,113
Camphor oil	133,633	Vegetable wax	1,549,595
Camphor	1,837,845	Bamboo ware	523,524
Chip-plait	233,527	Wooden ware	1,115,623
Wicker trunk	166,913	Cocoa oil	6,846,732

Of the greatest importance from the standpoint of forest resources, of course, is the export of timber. Export increased for the three years from 1916 to 1918. The values of imports and exports for these years are shown in Table 224.

Table 224.—Exports and Imports of Wood

Year	Exports				Imports		
	Railroad ties	Boards for tea-chests	Match sticks	Other timber	Teak	Pine, fir, and cedar	Ebony, sandal-wood, etc.
1916	$659,000	$1,379,000	$386,000	$3,490,000	$ 70,000	$ 684,000	$141,000
1917	760,000	4,206,000	580,000	1,824,000	163,000	1,663,000	169,000
1918	976,000	3,824,000	948,000	2,805,000	263,000	4,014,000	313,000

Forest Industries.—The recent development of commerce and industry in Japan has very greatly increased the demand for lumber for railways, shipbuilding, and mining, as well as for general industrial purposes, such as building, road-making, and fuel. There is also a steadily increasing export of lumber to Chosen, Manchuria, and China, countries with limited or still undeveloped forests. The gradual development of means of communication, both roads and railways, has also given impetus to the lumber industry. In 1914 the number of sawmills in Japan was 1,874, using 36,760 horsepower. In 1916 the number of mills increased to 2,404, utilizing 45,300 horsepower. The government owns 10 sawmills. The lumber industry of Japan is still relatively undeveloped as compared with the large percentage of land under forest.

The Pulp Industry.—Among the various new industries which sprung up in Japan during the war as a result of the specific economic conditions created by the war, the most prominent place belongs to the pulp industry. Before the war several Japanese paper factories owned pulp mills. The output of these mills, which in 1913 was about 76,000 tons, was not sufficient to meet the needs of domestic consumption. As a result, Japan imported from abroad considerable quantities of pulp. The imports during the last few years assumed the proportions shown in Table 225.

TABLE 225.—IMPORTS OF PAPER PULP

Year	Weight	Year	Weight
	tons		tons
1913	53,167	1917	15,652
1914	49,513	1918	31,415
1915	58,625	1919	44,315
1916	63,029		

The sudden reduction of imports in 1917 is due to the difficulty which Japan experienced in getting pulp from Germany and the Scandinavian countries, which before the war were the chief suppliers of this product. According to the figures of the Japanese Customs Office,[1] the import of pulp into Japan for the years given above was distributed among the different countries, as shown in Table 226.

As can be seen from this table, during the war Canada assumed the predominant place on the Japanese market. At present, however, the United States is forging ahead of Canada and has considerably developed its export of wood pulp to Japan; Sweden is also increasing its export, since with the close of the war it has been trying to reestablish its former connection on the Japanese market. Recently Japan has also made contracts with Finland for the delivery of pulp.

The first attempt at the production of pulp in Japan was made by a paper factory in 1889. This was soon followed by several other paper factories, but these attempts at first were extremely limited in character. After the Russian-Japanese war, when the paper industry in Japan underwent sudden rapid development, the production of pulp was transferred to the north of Japan, to the Island of Hokkaido, which has large forest areas. It received there a much wider and technically better equipped development. The total amount of pulp produced by the Japanese mills in the year just preceding the war amounted to nearly 80,000 tons.

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[1] The total imports given in Table 226 are less than those in Table 225, being taken from different sources.

In 1912 the Japanese paper companies explored the northern part of Saghalien with the view of developing a pulp industry there, and in 1913 the first pulp plant was established in the southern part of Saghalien. The local conditions proved very favorable for the pulp industry, and in the following years there sprung up several large enterprises which had in view the exploitation of the forest resources of Saghalien for the production of pulp. In 1918 there were on Saghalien Island 10 pulp mills with an annual output of 143,500 tons and with prospects of their further development. These pulp mills produced chemical pulp (sulphite process) exclusively. In 1917 a pulp plant was established in Chosen. Its annual output at first did not exceed 4,000 tons, but since there are vast forests on the Yalu River which furnish much raw material the chances are that the pulp industry in Chosen will be greatly developed.

In all, according to the latest statistical data, Japan, including Saghalien Island and Chosen, has 22 firms for the production of pulp which operate 39 individual mills. The output of these mills for the last few years was as given in Table 227.

In 1917 several new pulp mills were built and the existing mills undertook development on a large scale. It is probable, therefore, that

Table 226.—Imports of Pulp by Countries of Origin

Country	Metric tons						
	1913	1914	1915	1916	1917	1918	1919
England....	2,886.6	1,806.0	2,943.0	303.6	....	....	....
Germany...	22,031.4	16,052.4	628.8	624.0	....	....	....
Sweden....	12,387.0	17,267.4	32,394.0	35,701.8	2,384.4	1,366.8	8,536.2
Norway....	3,903.0	5,579.4	7,935.0	7,945.8	102.0	....	426.6
Denmark...	657.0	183.0	370.8	....	....	....	....
United States....	1,326.6	1,092.0	2,001.6	7,795.8	3,211.8	9,406.2	15,211.2
Canada....	4,125.0	2,947.2	7,836.0	5,807.4	8,648.4	18,190.2	9,550.2
Other countries.....	88.8	774.0	....	....	101.4	36.0	1,180.8

TABLE 227.—PULP MILL OUTPUT

Year	Chemical pulp	Ground pulp
	tons	tons
1913	25,077	51,004
1914	30,032	59,842
1915	37,761	74,314
1916	54,947	80,021
1917	79,533	89,506

in 1918, for which there are no accurate figures available, the annual output of the Japanese plants greatly increased and probably reached 226,000 tons of chemical pulp and 186,000 tons of ground pulp. The best quality of Japanese, and especially of Saghalien, pulp corresponds approximately to the Swedish brands known as Three Crowns Brand and Two Crowns Brand, which are used most widely on the Japanese market. Among the largest pulp mills in Japan are the Nippon Chemical Pulp Industry, whose maximum output is 46,000 tons; the Karafuto Industrial Company with 50,000 tons, and the Karafuto Sangyo Company with 37,500 tons.

The entire output of pulp in Japan is used for satisfying the needs of the Japanese paper mills. Some time ago a small amount of pulp was exported from Japan to British India, but lately the export of pulp has been prohibited by the Japanese government. The consumption of pulp in Japan in 1918 reached the following amounts:

TABLE 228.—PULP CONSUMPTION

Source	Chemical pulp (sulphite)	Ground pulp
	tons	tons
Produced in pulp mills owned by the paper manufacturers	42,138	97,781
Pulp obtained from paper mills not owned by the paper manufacturers	43,415	13,432
Imported from abroad	25,113	901

These figures, however, show only the consumption of the Japanese paper mills which are members of the Union of the Japanese Paper Manufacturers. Although this union embraces the chief paper mills, yet the actual consumption of pulp in Japan must be slightly higher. There is no doubt that after the industrial crisis in Japan has passed the demand for pulp will again show an increase. In anticipation of this increase the Japanese paper mills, in order to become independent from the Scandinavian and American importations, are paying great attention to the neighboring countries, especially eastern Siberia, which, because of their vast forest resources, afford opportunities for the building of pulp mills to feed the Japanese paper mills.

The volume of wood consumed annually for pulp manufacture amounts to 34 million cubic feet. Fir (*Abies*), spruce (*Picea*), and hemlock (*Tsuga*) are chiefly used for this purpose. These species are abundant in central and northern Honshu, and large amounts of fir and spruce are also found in Hokkaido and in Karafuto (Saghalien). Most of the pulp factories have been located in these regions.

The Pencil Industry.—Japan now manufactures pencils in quantities sufficient not only to meet the entire home requirement but to export to foreign countries in competition with the product of Bavaria. In 1911 the export of pencils amounted to $23,928, in 1915 to $94,715, in 1916 to $623,125, and in 1917 to $997,000. The principal wood used is *Cercidiphyllum*, and it is feared that the supply may soon be exhausted by reckless cutting.

The Match Industry.—The match industry is of much older origin. The export of matches amounted in 1915 to $398,800, and in 1917 to $498,500. Japanese poplar was originally used very largely in this industry. As it was growing scarce, supplies of poplar began to be imported from Siberia. In 1912 the import of Siberian poplar totaled 15,000 cubic feet, and in 1917 it had increased to 90,000 cubic feet, or sixfold.

Wood Distillation.—Dry distillation of wood has also greatly developed within recent years. In 1913 the production of calcium acetate and its products was only 1,297 tons, and imports 4,132 tons. In 1917 the production had risen to over 9,400 tons, while imports, on the other hand, had fallen to less than 130 tons. Since the war, however, the calcium acetate industry has greatly declined.

Other Products.—The manufacture of board for tea chests, toys, cork, and acetic acid has also been increasing within recent years. The export of boards and barrels, which amounted to $1,146,550 in 1915, increased to $4,187,400 in 1917. The export of toys reached $997,000 in 1917.

The Growth of the Lumber Industry.—The growth of the lumber and wood-using industries in Japan is best reflected in the growth of the cut. The amounts cut in 1914 and in 1917 are given in Table 229.

The species utilized most were *Cryptomeria*, of which 106,930,970 cubic feet were cut in 1917 in Japan proper, and pine and spruce, which during the same period were cut to the extent of 105,746,920 and 26,259,630 cubic feet, respectively.

Table 229.—Cut of Timber and Firewood, Japan

Purpose	1914	1917
	cu. ft.	*cu. ft.*
Cut for lumber	230,000,000	420,000,000
Cut for firewood	1,770,000,000	2,045,000,000
Total	2,000,000,000	2,465,000,000

The Camphor Industry.—The extracting of camphor is a state monopoly. This monopoly was established in Formosa in 1899 and extended to Japan proper in 1903. The manufacture of synthetic camphor and competition on the part of southern China prevent, to some extent, Formosa camphor dominating the markets of the world. The world's consumption of camphor is now estimated at 13,500,000 pounds, of which about one-half is supplied by Formosa.

The supply of camphor trees in private forests in Japan proper has been nearly exhausted. Camphor trees in state and crown forests are still abundant, having been estimated at nearly 12,000,000 trees, capable of yielding about 2,519,500 cubic feet of wood for the extraction of camphor. As the tree must be over 60 years old before it yields a comparatively large amount of camphor, the supply must be very carefully managed if it is not to be exhausted. The government is encouraging the planting of young camphor trees, and eight provinces in southern Japan are granted subsidies for this purpose. In Formosa about $25,000 is spent every year by the government for planting and over 3,000 acres has already been planted. It is intended to increase the area of planting in Formosa and to bring it up to 50,000 acres by 1923. The area planted to camphor trees in Japan proper is about 2,000 acres. Experiments are now being conducted by Japanese chemists to extract camphor from young twigs and leaves after the tree is 4 or 5 years old.

Forestry Movement.—Although some evidence of planting and care of the forests in Japan extends back for 700 to 1,000 years, the empire did not take up the handling of its forests in a modern way until after the restoration in 1868. In 1907 there was created administrative authority to prevent the destruction of forests and to secure the planting of trees in both public and private forests as well as on waste land, exemption from taxation being granted where desirable. The clearing of forest land for cultivation may be restricted or prohibited. To make clear the relation between forests and water, meteorological observations are being conducted. Special subsidies are granted for the restoration of waste public forest lands which have been denuded of timber in the past and not replanted. Boundaries are being mapped and areas surveyed. The quantity of timber which may be felled annually to satisfy the home and foreign demand for lumber is limited so that the future lumber supply may not be endangered.

During the past 10 years the area planted in forests has averaged 320,000 acres annually. The trees most commonly planted are *Cryptomeria,* cedar, and pine, as well as oak, camphor, chestnut, and locust. Locust is being planted particularly on waste lands of Chosen, and foreign conifers and, to some extent, poplars, in Hokkaido. In Formosa the trees most generally planted are teak, several species of cinchona, and rubber. According to a report published in 1917 by the Department of Agriculture and Commerce, the number of seedlings set out during that year included 368,551,848 conifers, covering 252,041 acres, and 36,216,579 broad-leafed trees covering 30,057 acres, these figures being exclusive of Chosen, Formosa, and Saghalien. The greatest area, 387,000 acres, was planted in 1915, but this record has not been maintained owing to the increased cost of planting. It is of interest to note that during the same year 842,500 acres were cut over, on most of which there is natural reproduction either through sprouts or through regeneration from seed. This natural regeneration is not always composed of valuable species, however, and the forest shows evidence of deterioration.

Japan has four higher schools of forestry. Two are connected with the universities, one being at the Imperial University near Tokyo and the other at Sapporo, Hokkaido. The other two schools are of a more practical character. One is at Morioka and the other at Kagoshi. The Imperial University offers a three-year graduate course leading to a degree corresponding to Bachelor of Forestry. A forest experiment station, comprising 10 acres, was established 25 years ago in the neighborhood of Tokyo.

Probable Future.—In considering the future of Japan's forest industries, it is evident that the demand for timber and firewood in Japan will increase with great rapidity and on a large scale. Figuring on the basis that the total population is now about 78 million, and the amount of timber cut annually about 2,220,000,000 cubic feet, the consumption per head averages 28 cubic feet a year. The population in Japan is increasing very rapidly, and this alone will account for a constantly increasing demand. Furthermore, the industrial development of Japan is progressing at a rapid rate and the various industries demand constantly greater supplies of timber. It has been estimated that the per capita consumption of wood in Japan in the near future will be between 40 and 50 cubic feet. The demand will then become greater than the capacity of the forest to meet it on a sustained basis. As a matter of fact, even now in various localities there is a shortage of timber for engineering purposes, particularly large stock. As a result, the export of timber will decrease and in its place products manufactured from wood will be exported. This shortage of timber may even become more acute, as much of the cutting in the past has not been followed by natural regrowth and the average producing capacity of the forests has been greatly reduced. A yield of 20 cubic feet per acre per annum is about all that the Japanese foresters are expecting from their forests for many years to come. There will have to be a further reduction in the amount of cut in forests in the mountains where they are needed for watershed protection. Imports of timber are certain to increase greatly in the future. The greater part of these will probably come from the forests of Siberia, while Canada and the United States will supply considerable amounts.

Chosen (Korea)

Next to Japan proper, Chosen possesses the largest forest area, estimated at 29,375,395 acres and forming 53½ per cent of the total land area. Except in the northern regions covering the upper courses of the Yalu and the Tumen, the mountains of Chosen are bare, a result of reckless felling and neglect. Much of this mountain land is unfit for tree planting unless this is preceded by engineering works. The forest trees growing in the wooded portions of northern Chosen are cypress (*Chamaecyparis*), larch, fir, pines, and birch. Considerable planting has already been done in Chosen and in 1917 about 100 millions of seedlings were planted, including those planted by private persons. The government maintains nurseries and distributes planting stock free of cost. Chosen has now an Arbor Day (April 3) as a national holiday. At New Wiju the government has under its control about 5,390,000 acres of forests along the Yalu and Tumen Rivers, which are being logged.

Karafuto (Saghalien)

The northern portion of Saghalien is owned by Russia. The part south of 50° N., which belongs to Japan, still possesses dense primeval forests of good quality. The greatest obstacle to exploitation is lack of convenient transportation. Forest fires are very frequent and extensive. According to the latest official reports, Japanese Saghalien contains 7,350,275 acres of forest. Of this 5,302,937 acres is coniferous forest containing a stand of 1,662,945,646 cubic feet, 1,160,688 acres broad-leafed species, estimated to yield about 64,312,943 cubic feet, and 886,650 acres mixed forest with 174,017,128 cubic feet. Forest products, which constitute one of the principal exports of the island, were valued at

$447,894 in 1918. The conifers are fir, spruce, and larch, and among the broad-leafed species white birch, alder, and poplar predominate. Karafuto is expected to assume great importance in the manufacture of pulp and match stock sticks. There are at present ten pulp mills on the island.

Formosa (Taiwan)

The forest area of Formosa is roughly estimated at 7 million acres, including waste land, or nearly 80 per cent of the total land area. Although the island is situated in the tropical zone, the tropical lowland forests were cut over in the early settlement by the Chinese, and the coniferous forests in mountain regions are now the source of most of the lumber utilized in the island. Camphor trees, *Machilus* trees, and oaks, however, are still found in certain restricted districts. The amount of standing timber is placed at approximately 8½ billion cubic feet. Among the most important softwoods which are now being utilized are: cedar (*Chamaecyparis obtusa* and *Chamaecyparis formosensis*), which occurs in dense pure stands yielding on an average from 9,500 to 14,000 cubic feet per acre, though maximum stands of 33,000 cubic feet per acre have been reported; pine (*Pinus armandi* and *Pinus massoniana*), and hemlock (*Tsuga formosana*). Among other conifers are spruce (*Picea morrisonicola*), *Cunninghamia konishii, Taiwania cryptomerioides,* and *Libocedrus macrolepis.* The valuable softwood forests lie in the mountain regions between about 5,000 and 9,000 feet above sea level, and therefore logging railroads are essential to make them accessible. The government is now conducting logging operations in the mountain regions of Arisan, Hassenzan, and Taiheizan. The Arisan is a chain of mountains ranging from 2,800 to 8,700 feet above sea level. It lies east of Kagi, an important city in southern Formosa, and covers about 27,742 acres. The

Table 230.—Forest Plantations—Formosa

Year ended March	By the government		By private interests		Total
	Camphor trees	Other trees	Camphor trees	Other trees	
	acres	*acres*	*acres*	*acres*	*acres*
1913	3,665	2,187	3,377	....	9,229
1914	3,861	2,131	5,412	....	11,404
1915	3,898	1,305	5,505	6,334	17,042
1916	5,813	1,747	5,236	8,789	21,585
1917	4,110	1,235	6,429	9,968	21,742

stand is estimated at 106,064,472 cubic feet of conifers, and 218,488,272 cubic feet of broad-leafed trees. As the government utilization program beginning with 1915–16 calls for cutting every year 3,000,000 cubic feet of conifers and 1,200,000 cubic feet of other species, the supply should last from 35 to 182 years, respectively. As annual reproduction is provided for, the supply should be kept up permanently. Planting both by the government and by private individuals is conducted on a large scale, as may be seen from Table 230.

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THE MALAY PENINSULA

Forest Area.—The Malay Peninsula geographically begins at the Isthmus of Kra at 10° north latitude. Politically, the upper portion between the 7th and 10th parallels of north latitude must be regarded as a continuation of the Kingdom of Siam rather than as a section of the Malay Peninsula. The portion lying between the first and seventh parallels of north latitude is under British control. It comprises the Straits Settlements (Singapore, Penang, Province of Wellesley, Malacca, and the Dindings), the Federated Malay States (Perak, Selangor, Negri Sembilan, and Pahang), and the Unfederated or Protected States (Johore, Kedah, Perlis, Kelantan, and Trengganu),—a total land area of 33,600,000 acres (52,500 square miles). About 100 years ago practically the whole of the Malay Peninsula was covered with forests. The forests now occupy 22,570,240 acres, or 67 per cent of the total land area; they are distributed by provinces as shown in Table 231.

In spite of such a large percentage of forest land, the forests are not well distributed and some parts of Perak and Selangor are having difficulty in securing sufficient fuel for railroads, mines, and rubber factories. With a population of about 3,026,000 people the forest area per capita

TABLE 231.—CLASSIFICATION OF LAND AREA, MALAY PENINSULA

Division	Agricultural land	Forest			Other land	Total
		Merchantable	Unprofitable or inaccessible	Total		
Straits Settlements:						
Acres	704,000	106,240	64,000	170,240	90,880	965,120
Percentage of total area	73	11	7	18	9	100
Federated Malay States:						
Acres	1,920,000	8,640,000	4,800,000	13,440,000	2,240,000	17,600,000
Percentage of total area	11	49	27	76	13	100
Unfederated Malay States:						
Acres	2,688,000	4,800,000	4,160,000	8,960,000	3,383,040	15,031,040
Percentage of total area	18	32	28	60	22	100
Total:						
Acres	5,312,000	13,546,240	9,024,000	22,570,240	5,713,920	33,596,160
Percentage of total area	16	40	27	67	17	100

for the whole peninsula is 7.5 acres. Table 232 gives the per capita forest area by provinces.

TABLE 232.—PER CAPITA FOREST AREA

Division	Forest area	Population	Forest area per capita
	acres		*acres*
Straits Settlements	170,240	846,000	0.2
Federated Malay States	13,440,000	1,280,000	10.5
Unfederated Malay States	8,960,000	900,000	10.0

Character of the Forest.—The forests of the Malay Peninsula, as a general rule, are evergreen. Two large and distinct divisions are recognized:

I. Littoral forests
II. Inland forests

These may be further subdivided as follows:

- I. Littoral forests—
  - 1. Mangrove swamp forests
  - 2. Dry forests
    - (a) Casuarina belts
    - (b) Other coast forests
- II. Inland forests—
  - 1. Fresh-water swamp forests
  - 2. Dry forests
    - (a) Lowland forests (up to about 2,000 feet)
    - (b) High hill forests (over 2,000 feet)

Of the littoral forests, the most important commercially are the mangrove swamps; of the inland forests, those occupying the lowlands.

The Mangrove Swamps.—The mangrove swamps cover more than 300 square miles (192,000 acres), and are found chiefly on the west coast. They have been worked on a short rotation and therefore do not contain large-sized trees. It is claimed that the Malayan mangrove forests are superior in quality to those of eastern India and Burma. The species which make up the mangrove forests include chiefly: *Rhizophora conjugata*, Linn. (Bakau minyak) and *Rhizophora mucronata*, Lam. (Bakau kurap), *Bruguiera caryophylloides*, Bl. (Berus), *Bruguiera eriopetala*, W. et A. (Mata buaya), *Bruguiera gymnorhiza*, Lam. (Tumu), and

Bruguiera parviflora, W. et A. (Lenggadai), *Ceriops candolleana,* Arn, (Tengar), *Kendelia rheedii,* W. et A. (Pisang-pisang), *Avicennia officinalis,* Linn., *Avicennia alba,* Bl. The mangrove is the most highly prized wood for fuel.

Lowland Forests.—The lowland forests up to an elevation of about 2,000 feet are the most important forests of the peninsula. In many places more than 50 per cent of the stand is made up of dipterocarps, of which probably more than 100 species occur in the Malay Peninsula. These forests consist, as a rule, of a number of stories. The undergrowth is very thick and it is hard to move freely through it. More than half of the commercial timber of the Malay Peninsula is produced by the dipterocarps. The most abundant and important among them are the following:

Chengal (*Balanocarpus spp.*). Standard wood for heavy structural work and railroad ties. It is widely distributed and at one time was very common.

Keruing (*Dipterocarpus spp.*). Wood suitable for heavy construction and, if treated with preservatives, for railroad ties. It is moderately heavy and not durable in contact with the ground.

Kapur (*Dryobalanops spp.*). Wood moderately hard and heavy; suitable for heavy structural work; not durable in contact with the ground and therefore must be treated if used for railroad ties.

Meranti (*Shorea spp.*). Wood soft, light, and coarse-grained. The most abundant wood in the country. Used most widely for planking and in light or temporary structures; suitable also for veneers.

Meranti Pahang (*Shorea spp.*). A hard and heavy wood. Used for boat building and planks.

Merawan (*Hopea spp.*). Moderately heavy; very widely distributed; used for furniture and light structural work.

Resak (*Isoptera borneensis,* Scheff, and several species of *Shorea, Hopea,* and *Vatica*). A heavy, hard, strong wood. Widely distributed and known also as balau, chengal, pasir, giam, kumus, selimbar, and Sengkawang, according to the species or localities producing it.

Seraya (*Shorea curtisii,* Dyer). Wood soft, moderately light. Used for light or temporary structures and for light furniture. Suitable also for veneers.

Among other woods may be mentioned:

Bintangor (*Calophyllum spp.*). Soft and light. Used for masts and spars and for furniture.

Kelat (*Eugenia spp.*). Moderately heavy. Large trees furnish wood of good quality; wood from smaller trees is suitable only for fuel.

Keledang (*Artocarpus lanceaefolia,* Roxb.). A moderately heavy, coarse-grained and durable wood. Used for Chinese coffins.

Kempas (*Koompassia malaccensis*, Maing.). A heavy and coarse-grained wood, not durable in contact with the ground. Used for shingles and charcoal.

Keranji (*Scorodocarpus borneensis*, Becc.). Hard, heavy. Used for house posts.

Medang (various species of *Lauraceae*). Soft, light. Suitable for furniture.

Merbau (*Intsia* (*Afzelia*) *spp.*). Hard, heavy, strong, and very durable. Used for railroad ties, heavy construction, and furniture.

Nyatoh (*Palaquium spp.* and *Payena spp.*). Soft, light, coarse-grained. neither strong nor durable. Used for boat building.

Penaga (*Mesua ferrea*, L.). Hard, heavy, strong, and very durable.

Petaling (*Ochanostachys amentacea*, Mast.). Hard, strong, and durable. Very widely distributed and fairly common. Used for house posts.

Punggai (*Coelostegia griffithii*, Mast.). Soft and light. Used for Chinese coffins and clogs.

Rengas (*Melanorrhoea spp.*). Hard, heavy, and durable. Used for fine furniture. Handling it when freshly cut is apt to cause severe irritation of the skin accompanied by swelling.

Sepetir (*Sindora spp.*). Soft and light. Used for planks and furniture.

Simpoh (*Dillenia spp.* and *Wormia spp.*). Moderately hard, moderately heavy, very coarse-grained, and not durable in contact with the ground. Used for planks.

Tembusu (*Fagraea spp.*). Very hard and heavy, coarse-grained, strong, and very durable. Used for railroad ties, heavy structural work, and furniture.

Tempinis (*Sloetia spp.*). Very hard, heavy, fine-grained, and durable. Probably the strongest wood in the Malay Peninsula. Used for axe handles and house posts.

Character of Ownership.—With the exception of such forest land as has been alienated for rubber planting, mining, and other purposes, all the forests belong to the state. In the whole Malay Peninsula 90 per cent of the forest land is in government ownership. The distribution of the forest in 1919 according to ownership, by provinces, is given in Table 233.

Annual Growth.—No reliable figures of growth are available. The only forests that have been systematically managed are the mangrove swamps. Although yields as high as 4,000 cubic feet (80 tons) per acre have been obtained, 2,500 to 3,000 cubic feet (50 to 60 tons) per acre is about the average yield. With a rotation of 20 to 30 years this is equivalent to 100 cubic feet (2 tons) per acre per annum. For the entire mangrove forest, however, a more conservative estimate would be 75 cubic feet (1½ tons). The inland forests will yield on an average at the rate of about 25 cubic feet (half a ton) per acre a year. It is estimated that there are 13,546,240 acres (21,166 square miles) of merchantable forests in the whole peninsula, which, at 25 cubic feet (half a ton) per acre per annum for inland forests and 75 cubic feet (1½ tons) for the mangrove swamps, would yield about 350 million cubic feet (7 million tons) a year. This yield is probably not realized, as the alienation of distinctly forest land is still going on so that the area is constantly being reduced. Furthermore, the forest being unevenly distributed, certain sections cannot be benefited by this total increment and are already suffering from shortages of even such a common forest product as firewood.

Annual Cut.—The annual cut for the whole Malay Peninsula is about 262,500,000 cubic feet (5,250,000 tons), valued at the place of preparation at $20,185,290. The character of the cut is given in Table 235.

Loss.—The loss from waste and other causes has been estimated as almost equal to the annual consumption, that is, 275 million cubic feet. In the last 20 years waste was even greater than the annual consumption. In the Federated Malay States alone at least 2,500 million cubic feet of timber has been burned by the rubber planters.

Exports and Imports.—The Malay Peninsula, in spite of its large forest area, already depends on importation for supplying its wood

TABLE 233.—CLASSIFICATION OF THE FOREST AREA BY OWNERSHIP, 1919

Division	Area belonging to			Total
	State	Corporate bodies	Private individuals	
Straits Settlements:				
Acres	170,240	....	....	170,240
Percentage of total forest area	100	....	....	100
Federated Malay States:				
Acres	13,440,000	....	....	13,440,000
Percentage of total forest area	100	....	....	100
Unfederated States:				
Acres	6,720,000	1,600,000	640,000	8,960,000
Percentage of total forest area	75	18	7	100
Total:				
Acres	20,330,240	1,600,000	640,000	22,570,240
Percentage of total forest area	90	7	3	100

Table 234.—Average Annual Imports and Exports (Period 1913–1918)

Product	Value of exports			Value of imports			Difference[1]		
	To British possessions	To foreign countries	Total	From British possessions	From foreign countries	Total	For British possessions	For foreign countries	Total
	$	$	$	$	$	$	$	$	$
Firewood	310	654	964	294	334,978	335,272	+16	−334,324	−334,308
Charcoal	1,119	12,354	13,473	1,389	139,448	140,837	−270	−127,094	−127,364
Planks	318,038	551,412	869,450	4,301	213,283	217,584	+313,737	+338,129	+651,866
Timber	51,347	41,765	93,112	13,869	658,190	672,059	+37,478	−616,425	−578,947
Total	370,814	606,185	976,999	19,853	1,345,899	1,365,752	+350,961	−739,714	−388,753

[1] A plus sign indicates excess of exports over imports; minus sign indicates excess of imports over exports.

demands. While the Federated Malay States and the Unfederated States are self-supporting, the Straits Settlements import about 12,500,000 cubic feet a year from the Dutch East Indies and Siam. Most of the teak is imported from Siam, and other hardwood timber and mangrove firewood and charcoal from the Dutch East Indies. Exports are mainly re-exports of rough hewn timber brought into the country after sawing at the Singapore sawmills. The imports are increasing while the exports are decreasing, pointing to a continued increase in the wood consumption in the peninsula. The values of exports and imports are shown in Table 234.

TABLE 235.—ANNUAL CUT.

Ownership	Kind of product	Quantity	Value at the place of preparation
		cu. ft.	
Forests under state control	Timber	25,000,000	$ 8,517,000
Forests under state control	Firewood	197,500,000	11,214,050
Forests attached to rubber plantations	Firewood	40,000,000	454,240
Total		262,500,000	$20,185,290

Domestic Consumption.—The annual consumption in the Malay Peninsula is placed at 275 million cubic feet. Of this 150 million cubic feet are used in the Federated Malay States, 75 million cubic feet in the Straits Settlements, and 50 million cubic feet in the Unfederated States. This represents a per capita consumption for the entire peninsula of 91 cubic feet.

By provinces the per capita consumption is as follows:

Federated Malay States	117 cubic feet
Straits Settlements	89 cubic feet
Unfederated States	56 cubic feet

TABLE 236.—COMPARISON OF CUT, CONSUMPTION, AND GROWTH

Item	Total	Per capita
	cu. ft.	*cu. ft.*
Annual cut	262,500,000	87
Consumption of home-grown timber	262,500,000	87
Net imports	12,500,000	4
Total consumption of home-grown and imported timber	275,000,000	91
Net growth	188,256,000	62
Deficiency	86,744,000	29

Comparison of Consumption and Growth for the Forests as a Whole.—The present annual consumption is undoubtedly less than the present gross annual growth. In some places, however, the total annual growth in the merchantable forest is, or soon will be, less than the total annual consumption. The situation is summed up for the entire Malay Peninsula in Table 236.

Forest Industries.—The only forest industry of any importance is lumbering. It gives employment to about 30,000 persons, a considerable number of whom, however, are not employed permanently. Except in Singapore there are no sawmills of any size. There is a match factory in Selangor and a wood distillation plant is contemplated in Pahang. A company in Johore has commenced to make compressed boards from waste wood. There are a few other minor industries on a small scale, such as tapping for dammar-penak and for wood oil, making dammar torches, weaving mats, cart and boat building, and charcoal burning. Singapore is one of the world's most important markets for canes. Only a small proportion of the canes, however, are grown in the Malay Peninsula. Large quantities in the rough state are imported from the Malay Archipelago, cleaned and prepared in Singapore, and then re-exported, chiefly to India, western Europe, the Far East, and the United States. Singapore is also the world's market for gutta-percha, large quantities of which were formerly produced in the Malay Peninsula. The extracting of gutta-percha, however, involved the destruction of the trees, with the result that comparatively few of the true gutta-percha trees are left in the Peninsula. Plantations of gutta-percha trees are now being established, and in the near future the Malay Peninsula may again become an important source of supply.

The principal dammar resins of the Malay Peninsula are derived from a number of dipterocarps, the most important being the transparent dammar-penak or dammar-chengal, yielded by *Balanocarpus* spp. and produced chiefly in Negri Sembilan. The inferior dammar resins, known as dammar-batu, are of comparatively little value and are seldom extracted for trade purposes.

Ports.—Singapore, at the southern end of the Peninsula, and Port Swettenham and Penang on the west coast, are the most important ports. The east coast is devoid of good harbors.

The Probable Future.—The Malay Peninsula is developing very rapidly. Much of the forest land is still being cleared for other purposes. With the use of wood as fuel, the drain upon the forests is very great and will increase still further with the development of the country. The forests of the Straits Settlements, with the exception of

Dindings, would be exhausted in a few years if the imports of timber should cease. Pahang alone in the Federated Malay States is at present assured of an adequate permanent supply of wood. In the greater part of Selangor, in the south of Perak, and in the west of Negri Sembilan, exhaustion is almost in sight. It is therefore likely that even with the best care of the remaining forests and economies in waste the forests of the Malay Peninsula will be just enough to maintain its future industries and population.

The Forestry Movement.—Ordinances governing the forests of the Straits Settlements and of the Federated Malay States follow more or less closely the provisions of the Burma forest act. They provide for the better protection of forests and forest products. The Unfederated States, with the exception of Trenggau, have separate forest enactments, providing for reserves, royalties, etc. The only forest ordinance of Trenggau, which forbids export of chengal, is not well enforced.

Little has been done toward developing the forests,. owing to lack of trained personnel. Fire protection is unnecessary because of the abundant rainfall of the country. A little experimental planting has been done on waste lands, though without results; blanks in the mangrove swamps have been replanted, and more or less successful attempts have been made to introduce certain valuable species in the forests where they are lacking. Although it will probably be necessary later to plant trees for fuel, the present object of the Forest Department is to aid regeneration of the more valuable species. Improvement fellings of camphor, gutta-percha, and some of the *Shorea* species have been successful, but only a small area—about 40,000 acres—has been treated, owing to the high cost and scarcity of labor.

About 2 million acres has been planted by private enterprise in the Malay Peninsula. The crop, however, is Para rubber, and to some extent gutta-percha, but not wood. Although the fuel question is beginning to be pressing, nothing has been done toward raising firewood.

Forest Administration.—The present forest authority of the Straits Settlements and the Federated Malay States is vested in a conservator, a forest research officer, deputy commissioners, assistant conservators, extra assistants, and a staff of rangers, guards, clerks, etc. The department is administered by the conservator, who also acts as technical advisor. He is consulted in the Federated Malay States, but has no authority in the Unfederated States. The conservator has general supervision in forestry matters, and makes estimates of expenditures, subject to approval by the government. The forest officers collect revenue, carry out plans of forest management, and enforce the ordinances and rules. In the Federated Malay States these officers may, with certain limitations, prosecute offenders, collect fines, and issue licenses.

Revenue.—The revenue per acre of the forests of the Straits Settlements for 1918 was $0.0063; for 1919, $0.1057. For the Federated Malay States the revenue for 1915 was $0.008; 1916, $0.01; 1917, $0.0157; 1918, $0.0218; 1919, $0.0207. Data for the Unfederated States are incomplete and little is known regarding their resources.

Education and Research.—The only educational work in forestry in the Malay Peninsula up to this time has consisted of field work and a recently established course of instruction in timber identification, given by the forest research officer. A central training school for the three countries has been considered.

Much important botanical work has been done in the Malay Peninsula, and some research work has been accomplished. Since 1916, more than 3,000 trees of about 25 different species have been measured each year, the commercial timbers of the peninsula have been studied, and a report on consumption, supply, etc., will soon be published. A forest herbarium, established in 1916, contains specimens of 1,700 species. No regular research branch exists as yet, but provision for this will probably be made by the government before long.

Field experiments, which have consisted of attempts to replant tin-mining lands, have not met with success because of lack of supervision.

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MESOPOTAMIA

The Province of Mesopotamia, formerly a part of the Ottoman Empire, was conquered during the world war by the British. It was recognized as an independent state by the terms of the peace treaties, and placed under the mandate of Great Britain. The total area of Mesopotamia is 91,680,000 acres, and the population in 1920 was 2,849,282.

It is believed that in ancient times Mesopotamia was well supplied with forests. Now, however, except for fruit trees and stunted oaks, the country is almost destitute of timber. The only trees remaining in Irak are date palms, tamarisks, and a few poplars which are used as fuel. There are occasional oak groves in the northern part of the country, especially east of Suleimanie. The Kurdish hills formerly contained abundant forests, but they are now being denuded, and the young growth is badly damaged by herds of goats. Poplar and sycamore grow in small amounts, but the principal tree is stunted oak, valued chiefly for gallnuts.

Reforestation is of great importance in Mesopotamia, both as a means of controlling floods, and of conserving moisture in the soil.

No statistics are available regarding the cut, growth, and consumption of wood in Mesopotamia. It is probable, however, that not less than 5 cubic feet per capita is used annually, of which perhaps 95 per cent is firewood and other small material. The total consumption, then, may be estimated at 14,246,000 cubic feet. Most of this is cut from scattered trees, rather than from forests. Small amounts of structural timber are imported.

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PALESTINE AND SYRIA

Under the terms of the peace treaty of August 10, 1920, Syria, formerly a province of Turkey-in-Asia, was recognized as an independent state and placed under the mandate of France. The total area of Syria is about 38,400,000 acres, and its population is less than 3 million.

Palestine, also formerly under Turkish rule, is now under the mandate of Great Britain. The area of Palestine since the British occupation is about 5,760,000 acres, and includes only the part west of the Jordan River. Under Turkish dominion the area was over 8,768,000 acres. In 1919 the population was 647,850, but in 1920 it was increased by the immigration of 10,000 Jews.

Forest Area.—Very little forest, in the strictest sense of the word, remains in Syria and Palestine. In 1915 it was estimated that about 770,000 acres in Syria and Palestine were covered by woodland. This would make 1.7 per cent of the land area and 0.2 acre per inhabitant.

Character of the Forest.—The principal wooded areas are in the hills of the northern and central parts of the country—on Jebel Ansariyeh and the Lebanon—the highest proportion being found in the *cazas* of Beilan, Alexandretta, Antioch, and Jisr. The prevailing species of these regions is Aleppo pine. In the vilayet of Damascus (for example, in the Ajlun district) stunted oak trees are prevalent. In western Palestine even small groves of trees, such as those on Carmel and Mt. Tabor, are rare. Extensive plantations of eucalyptus, made in 1900 by Jewish colonists at Khudheireh, were cut down for fuel and railway purposes during the war.

Official statistics for 1915 distribute the forest area among the vilayets as shown in Table 237.

TABLE 237.—FOREST AREA, SYRIA AND PALESTINE

Vilayet	Acres
Aleppo	333,450
Damascus	150,670
Beirut	135,850
The Lebanon	148,200
Total	768,170

Data on the distribution of species are meager and probably not very reliable. Estimates for 1907–8 are as follows:

	Per cent
Vilayet of Aleppo:	
Pine and fir	53
Oak	35
Vilayet of Beirut:	
Pine and fir	75
Oak	21
Vilayet of Damascus:	
Oak only.	

Most of the best forests of Asia Minor are found above an elevation of 4,000 feet. The famous "cedar of Lebanon" was practically exhausted as early as 1,000 B. C., and the pines of Mt. Amanos were cut to a great extent. Since the readjustment of boundaries, these mountains are in Syria, and the future of the remaining forests of that region will depend upon France, under whose control Syria was placed by the treaties.

Character of Ownership.—State ownership prevailed under Turkish rule, approximately 88 per cent of the forests of the Empire being in state control. This condition still prevails, and except in the Lebanon very little forest is in private hands. According to statistics for 1907 and 1908, the vilayets of Aleppo, Damascus, and Beirut contain only about 4,950 acres of privately owned forest. In the Lebanon, which is not included in the statistics, the forests are entirely owned either by individuals or by communities.

Forest Legislation.—Although the Turkish government had laws for the regulation of the forests, they were not enforced, and much damage has been and still is done by fire, indiscriminate and wasteful cutting, and grazing. The summers are long and dry, with high winds, and most of the timber is resinous. Fires are often started accidentally or intentionally by shepherds, and grazing animals devour the young growth. Another unfortunate aspect of forest destruction is that the soil is thin and slow to form, and when the forests on the mountain slopes were destroyed the heavy winter rains washed off the thin soil. This makes restoration of the tree growth practically impossible. The Turkish forest officials were notoriously careless, inefficient, and indolent, and there is a general lack of appreciation of the value of forests. The consequences of destruction are being felt in marked changes of temperature, drying up of the water courses, scarcity of water, and the necessity for providing ditches and other means of irrigation at enormous expense. The grazing of sheep and cattle is regarded as a right by the native population, and for this reason will be difficult to control.

Some successful planting has been done by German and Jewish colonists. For instance, Mt. Carmel, which was quite destitute of forest 40 years ago, is now covered with thrifty groves of *Pinus pinea,* and the holm oak groves of Hardije, near Bethlehem, have shown most satisfactory results. There are also some fine groves of holm oak on Mt. Tabor, belonging to a Franciscan monastery.

It is said that projects for replanting have been started on a small scale in the neighborhood of Jerusalem, where a nursery distributes trees for planting free of charge. It is likely that Jewish colonists will undertake the reclamation of the sand dunes in the districts of Jaffa and Gaza by planting with pines, as was done in the Gascon Landes.

These beginnings, though small, show what may be done. In order to increase the general forest production of Palestine it would be necessary to provide and enforce adequate measures for forest protection, and to educate the inhabitants to understand the disastrous consequences of forest destruction. There seems at present, however, very little chance that even hard work and great expenditure of money will make Palestine a timber-producing region. The future of Syria in this respect probably lies, as has been pointed out, in the hands of the French government.

Cut, Imports, and Consumption.—Most of the timber of the region is used for fuel, the better grades of building and cabinet woods being imported. The output of timber in the vilayets of Aleppo, Damascus, and Beirut in 1907 and 1908 was valued at $317,500. Counting the by-products and the consumption of wood by the villagers, the value of the annual production of the forests may be estimated at from $580,000 to $770,000. The annual cut, which is approximately equal to the consumption, has been estimated at about 5 cubic feet per capita, or 18,289,000 cubic feet altogether. Of this, 95 per cent is firewood.

Every year the demand for box material in Palestine is growing. In 1910 about one million boxes at 20 cents a box were used. With the agricultural development of both Palestine and Syria under the new political regime, the demand for wood will undoubtedly increase. In the past most of the timber that entered the ports of Jaffa, Smyrna, and Beirut came from Austria, Russia, and Rumania. Undoubtedly the same countries will continue to be the chief sources of supply.

Principal Trees.—Some of the principal fuel and timber trees of this region are given in Table 238.

TABLE 238.—PRINCIPAL TREES AND THEIR USES, PALESTINE

Terebinth (*Pistacia terebinthus*)	Fuel.
Maple, three species	Good fuel.
Pride of India (*Melia azedarach*)	Shade, building timber, fuel.
Jujube (*Zizyphus* spp.)	Fuel.
Christ thorn (*Z. spina-Christi*)	
Carob	
Acacia (sant, *Acacia nilotica*)	Building timber, fuel. Durable.
Ash	Building and fuel.
Sycamore (*Platanus orientalis*)	Fine timber.
Evergreen oak (*Quercus coccifera*)	Good timber and fuel.
Also Portuguese, scrub, and Lebanon oak.	
Hornbeam	Fuel.
Willow, several varieties	Many purposes.
Poplar, several varieties	Building and fuel.
Aleppo pine	Most widely distributed pine of Syria.
Stone pine	Roofing timber and fuel.
Juniper, several varieties	Timber and fuel.
Cedar of Lebanon	Formerly very abundant at an altitude of about 6,000 feet. Now practically destroyed.

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PERSIA

Forest Area.—The total land area of Persia is 401,920,000 acres, and the population, based only upon estimates, numbers between 8 and

10 million. Except the Caspian Provinces, it is a treeless country. The forests cover about 8 per cent of the total area, or a little over 32 million acres.[1] Even at a population of 10 million, this represents a per capita forest area of 3.2 acres, an excessively large area which would, under normal conditions, indicate a vast forest wealth sufficient for domestic consumption and for large exports as well. The difficulty, however, is that a large part of the country is mountainous or desert, difficult to cross, the population is distributed in widely scattered irrigated spots, and each part tends to live to itself. The difficulties of transportation are responsible for the great scarcity of timber over a large part of the country and great forest wealth in other parts. Thus, although there are large forests not more than 120 miles from the capital city, up to the present they have been little utilized, owing to lack of suitable means of transportation. Forests of commercial importance are located only in the northern and western portions of Persia. The Elburz Mountains, in the Provinces of Ghilan and Mazaderan, contain exceptionally good forests. The forests of Kurdistan and Arabia are less dense. The forested regions contrast sharply with the remainder of the plateau of Iran, which is almost entirely destitute of trees.

Character of the Forest.—Because of the warm climate and good soil conditions the forest vegetation is extremely varied. In the forests of Persia near the Caspian Sea there occur oak (four species), beech, several species of maple, hornbeam, alder, elm, ash, walnut, sycamore, poplar, pomegranate, boxwood, and others. The forests occur principally on mountain slopes, ascending to a height of from 6,000 to 7,000 feet. A characteristic feature of the Persian forests is the predominance of hardwoods and almost complete absence of conifers. In the lowlands the forests consist chiefly of alder, hornbeam, and locust; in the mountains of oak, beech, and hornbeam. In the foothills up to 2,000 feet hornbeam predominates over oak and beech, although oak occurs in considerable quantities together with maple, basswood, ash, and beech. Above 2,000 feet begins the zone of oak forests, in which oak forms often as much as four-fifths of the entire stand and frequently even pure stands. At altitudes of from 5,000 to 7,000 feet the predominant species is beech, and oak and other hardwoods become subordinate species.

On the Caspian shore of Persia in the Ghilan province there are oak forests of exceptional growth and quality. Before the war a Russian-Persian lumber company was interested in exploitation of the Persian forests near the cities of Resht and Enzeli. Explorations made by this lumber company over an area of nearly 400,000 acres showed that 125,000 acres were under pure stands of oak or mixed stands in which oak formed about one-third of the stand. The remaining 275,000 acres were covered with mixed hardwoods. Because of their remoteness from population and their location in the mountains, the forests have been very little exploited and a large part of the area barely touched. As a result they are composed of old trees of large dimensions and the stand per acre is considerable. Thus in the more valuable pure oak forests the number of trees per acre 3 inches in diameter breast-high and over runs as high as 111. Of this number there may be from 22 to 56 trees which are above 9 inches in diameter, and the stand per acre ranges from 5,000 to 6,000 cubic feet. The average height of the oaks is from 80 to 95 feet, while the exceptional trees may even have a height of 140 feet. In the dense stand in which these forests grow the oaks are clear of branches to a height of 48 to 50 feet, have little taper, and are of great value. Besides oak, ash, beech, maple, and boxwood are also of high economic value.

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[1] Estimates furnished by the French Legation at Teheran in 1913.

Character of Ownership.—All the forests are in government ownership.

Annual Growth, Cut, and Consumption.—No figures are available as to the total annual cut, growth, and consumption. Because a vast portion of the country is treeless, the population scattered, the climate warm, and the lumber industry undeveloped, and because there is an abundance of oil, the cut at present is below the productive capacity of the forest.

The cut and consumption cannot be much greater than that of the neighboring country, Turkey—15 cubic feet per inhabitant. At this rate the total consumption of the country is about 150 million cubic feet, a large part of which consists of poplar and other woods grown along the water courses in the dry interior districts.

Exports and Imports.—The trade statistics obtained from the Statistique Commerciale de la Perse indicate an excess (by weight) of exports over imports amounting to near 13,000 metric tons. (Table 239.)

The imports of wood and manufactures of wood into Persia during 1914 were valued at $614,306. The chief items of import are structural timber and lumber, which represent by weight 80 per cent of the total (average for three years, 1911–13, 86 per cent), most of it coming from Russia, less than one-sixth from British India, less than 5 per cent from Turkey, and the remainder from various British possessions. The excess of exports over imports is probably only apparent. When measured in actual cubic feet of wood in the log the imports and exports may compensate each other. The imports consist mostly of manufactured or semi-manufactured timber, while the bulk of the exports is largely unclassified raw material. The amount of wood in the log represented in imports, therefore, may compensate if not exceed the excess

TABLE 239.—IMPORTS AND EXPORTS OF WOOD, BY KINDS, PERSIA, 1910–1913

Kind of product	Imports (metric tons)				Exports (metric tons)			
	Country	1910–1911	1911–1912	1912–1913	Country	1910–1911	1911–1912	1912–1913
Building timber and cabinet wood	British Empire	19	39	330	Afghanistan	1	...	...
	British Indies	811	887	1,744	British Empire	124	4	69
	Russia	7,366	9,891	13,430	Germany	...	...	...
	Turkey	431	309	369	Austria	...	...	...
	Oman (Muscat)	2	54	251	France	180	76	...
	Zanzibar	212	366	...	Russia	3,283	3,376	5,493
					Turkey	86	47	175
					Oman	5	315	153
	Total	8,841	11,546	16,124	Total	3,679	3,818	5,890
Manufactured wood other than furniture and vehicles	Germany	...	...	3	Afghanistan	3	5	9
	Austria	...	...	...	Austria	...	...	...
	British Empire	1	17	4	British Empire	2	1	3
	British Indies	48	13	6	British Indies	...	...	...
	United States	...	...	...	Russia	365	1,114	2,796
	France	...	...	...	Turkey	2	8	110
	Russia	342	1,352	407	Oman (Muscat)	121	11	78
	Turkey	5	9	1				
	Oman	...	...	...				
	Total	396	1,391	421	Total	493	1,139	2,996

TABLE 239.—IMPORTS AND EXPORTS OF WOOD, BY KINDS, PERSIA, 1910–1913—*Continued*

Kind of product	Imports (metric tons)				Exports (metric tons)			
	Country	1910–1911	1911–1912	1912–1913	Country	1910–1911	1911–1912	1912–1913
Unclassified, including fuel	British Empire.	183	100	144	British Empire.	3,526	6,236	6,231
	British Indies. .	61	54	9	British Indies. .	9	43	....
	Russia.	363	761	185	Russia.	11,607	14,950	11,213
	Turkey.	894	1,117	399	Turkey.	44	18	4
	Oman (Muscat)	286	148	416	Oman (Muscat)	2,307	1,733	5,147
	Zanzibar.	470	....	....				
	Total. . . .	2,257	2,180	2,153	Total. . . .	17,493	22,980	22,595
	Grand total. . .	11,494	15,117	18,708	Grand total. . .	21,665	27,937	31,481
Excess of exports over imports.						10,171	12,820	12,773

of exports by weight. The present figures taken at their face value, however, would seem to indicate that there is an excess of exports over imports amounting to approximately 600,000 cubic feet a year. There is no question that Persia may still further develop her timber resources. At the same time, however, with better internal means of transportation the domestic requirement for wood will undoubtedly increase, so that very little surplus will be available for neighboring countries.

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PHILIPPINE ISLANDS

The Philippine Islands lie between the fifth and twenty-first degrees north latitude, directly south of the east coast of China. The group consists of 11 large and about 2,000 small islands. All of the large islands and many of the small ones are mountainous, with ranges generally extending in northerly and southerly directions. These ranges commonly reach elevations of 3,000 feet or more above sea level, the highest points being over 10,000 feet. The population of the Philippine Islands is estimated at 9,000,000. It is confined mostly to the sea coasts and to a few of the larger valleys, only a small number of people living back in the mountainous areas where the virgin forests occur. Those living in such regions are practically all of the non-Christian tribes. The coastal population belongs to different so-called Christian tribes. The total land area of the Philippine Islands is 76,800,000 acres (120,000 square miles), and the character of the land may be classified approximately as shown in Table 240.

Table 240.—Utilization of Land Area, Philippines

Classification	Acres	Per cent
Virgin forest	25,600,000	33⅓
Second-growth forest	12,800,000	16⅔
Grass land	30,720,000	40
Cultivated land	7,680,000	10
Total	76,800,000	100

Much of the so-called "second-growth forest" is of value only for local or domestic use. The virgin forests are of chief interest, since they contain practically all of the present stand of commercial timber. Five distinct forest types may be distinguished:

1. *Dipterocarp*
2. *Molave*
3. *Pine*
4. *Mangrove*
5. *Mossy*

The area and amount of standing timber within each type is as follows:

TABLE 241.—AREA AND AMOUNT OF TIMBER BY TYPES

Type	Estimated area			Estimated volume of standing timber (million board feet)
	Per cent	Square miles	Acres	
Dipterocarp	75	30,000	19,200,000	192,000
Molave	10	4,000	2,560,000	7,680
Pine	5	2,000	1,280,000	2,560
Mangrove	2	800	512,000	1,024
Mossy	8	3,200	2,048,000	Protective
Total	100	40,000	25,600,000	203,264

1. *Dipterocarp.*—These are the forests in which species of the dipterocarp family form the predominating timber trees. In general they occupy the regions where growing conditions are most favorable. These vary topographically from moist river bottoms to hilly and mountainous country. The composition of the dipterocarp forest is generally very complex. It consists as a rule of several stories. The first story is occupied by large dominant trees, usually dipterocarps. Under this upper story of dominant trees is an understory of small sub-dominant trees of great variety but generally of minor commercial importance. Still below the sub-dominant trees are the smaller kinds of tree species and a heavy growth of herbs and shrubs. Over and through the whole mass of trees, shrubs, and herbs is almost invariably a tangle of vines, among which climbing palms or rattans are most conspicuous. To give a concrete idea of the composition and the stand of this type of forest the following figures, based on averages of different tracts that have been examined in different localities and including trees only over 16 inches in diameter, may serve as an illustration:

	Feet B. M. per acre
Northern Negros (Low hill forest):	
Dipterocarps (6 species)	42,900
All other species	2,300
Total	45,200
Eastern Mindoro (river plain):	
Dipterocarps (4 species)	9,400
All other species	6,900
Total	16,300
Mindanao Island:	
Dipterocarps (10 species)	13,600
All other species	15,300
Total	28,900
Bataan Province (hilly to mountainous):	
Dipterocarps (6 species)	19,600
All other species	8,900
Total	28,500

2. *Molave.*—This type is so called because molave (*Vitex parviflora*), one of the hardest and most durable woods of the Philippine Islands, is the characteristic tree. This type occurs on drier sites, usually in the lower hills. The forest is much more open than the dipterocarp forest; the average stand per acre is not more than 3,000 board feet, while the maximum stands may contain 9,000 or 12,000 feet.

3. *Pine.*—In the high mountainous region of northern Luzon, nearly all of which is over 3,000 feet in elevation, there occurs an almost pure forest of pine (*Pinus insularis*). Occasionally the stands run as high as 10,000 to 20,000 feet per acre, but as a general rule they are very open and scattered.

4. *Mangrove.*—This type occurs on the tide flats at the mouths of streams and on the shores or protected bays. The mangrove swamp forests produce great quantities of firewood, while the bark of many species is used for tannin extraction. Along streams in many parts of the tide flats there occurs also a palm known locally as nipa. The leaves of the nipa palm are of greatest importance to the natives of the islands, since they use them almost exclusively for thatching roofs and sides of the native houses.

5. *Mossy.*—This is a mountain type of forest of no commercial value which occupies the higher mountain tops all over the islands. Its importance is chiefly as a protective cover.

Character of Ownership.—The state owns nearly all of the forests, 97.5 per cent, or 37,440,000 acres, while private forests constitute only 2.5 per cent, or 960,000 acres.

Annual Growth.—The annual growth has been estimated by Dr. H. N. Whitford at 554,598,300 cubic feet. This represents an average annual growth of 14.4 cubic feet per acre, or 61.6 cubic feet per head of population.

Annual Cut.—The average cut of timber for the last ten years was about 11,015,612 cubic feet. The cut in 1910 was 6,239,557; in 1919 it was 17,728,700 cubic feet, or an increase of 184 per cent. The cut of firewood in 1919 amounted to 16,021,500 cubic feet. The total cut of timber and firewood in 1919 on both public and private lands was thus 33,750,200. There are at present about 70 sawmills of all sizes and descriptions operating in the islands. Of these, however, only 12 can be compared to the average modern sawmills in the United States. The larger mills are located on timber concessions, while the others are operated under short-term licenses. The total cut is about 65 to 70 million board feet per year, or 5,833,000 cubic feet.

Annual Consumption.—With an annual cut of both timber and firewood of 33,750,200 cubic feet and an excess of exports over imports of only 27,000 cubic feet, the annual consumption is 33,723,200, or 3.7

TABLE 242.—EXPORTS AND IMPORTS, PHILIPPINES

Exports

Kind of product	Fiscal year 1913		Kind of product	Calendar year 1914	
	Amount	Value		Amount	Value
	cu. ft.			*cu. ft.*	
Timber	18,744	$ 9,663	Timber	62,410	$ 30,872
Lumber	357,750	214,814	Lumber	646,667	309,764
Furniture	....	12,395	Furniture	....	35,991
Total	....	$236,872	Total	....	$376,627

Imports

Kind of product	Fiscal year 1913 Value	Calendar year 1914 Value
Railroad ties	$ 23,773	$ 2,712
Timber	27,782	61,433
Lumber	546,373	482,738
Furniture	125,703	92,943
All others	133,316	131,963
Total	$856,947	$771,789

cubic feet per person. Of this, 17,701,700 cubic feet is saw timber and 16,021,500 firewood. Not all timber and firewood cut in the Philippines is recorded, hence the domestic consumption is probably larger than the official figure for cut, probably close to 35,300,000 cubic feet per annum.

Exports and Imports.—The exports and imports of wood and wood products for the years 1913 and 1914 are given in Table 242. The imports from 1912 to 1918, and the countries furnishing timber from 1915 to 1918, are shown in Tables 243 and 244.

TABLE 243.—IMPORTS OF LUMBER AND TIMBER INTO THE PHILIPPINES

Year	Railroad ties[1]			Timber		Lumber		Total	
	Number	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
		cu. ft.		*cu. ft.*		*cu. ft.*		*cu. ft.*	
1912........	66,496	126,342	$35,035	67,141	$23,222	....	$352,148	....	$410,405
1913........	45,272	86,017	23,773	59,163	27,782	....	546,373	....	597,928
1913 (July–Dec.)......	9,000	17,100	4,804	97,604	37,753	....	138,979	....	181,536
1914........	2,000	3,800	2,712	121,962	61,433	....	482,738	....	546,883
1915........	....	....	....	107,488	42,789	....	123,776	....	166,565
1916........	....	....	....	17,474	9,081	415,340	159,952	....	169,033
1917........	3,508	6,665	1,780	137,494	35,575	239,969	97,492	....	134,847
1918........	1,305	2,542	330	10,166	4,756	512,521	234,116[2]	....	239,202
Average...	23,197	44,085	$12,443	82,466	$32,319	389,277	$284,743	515,828	$329,505

[1] The 1,305 ties imported in 1918 equalled about 1.9 cu. ft. per tie. This was used to estimate the number of cubic feet in previous years.

[2] Includes $70,010, value of cedar box shooks.

TABLE 244.—VALUE OF LUMBER AND TIMBER IMPORTS INTO THE PHILIPPINES BY COUNTRIES OF ORIGIN.

Imported from	1915	1916	1917	1918	Average	Per cent
United States.......	$127,560	$148,964	$118,506	$212,406	$151,859	85.7
China.............	3,904	1,753	3,097	458	2,303	1.3
British East Indies..	9,479	2,424	6,420	1,728	5,013	2.8
United Kingdom...	10	234	....	....	61	....
Germany..........	4,891	1,640	5,401	802	3,184	1.8
Italy.............	11	....	....	....	3	....
Netherlands........	20,089	13,228	....	....	8,329	4.7
French East Indies...	565	790	686	376	604	0.4
Japan..............	56	....	569	2,248	718	0.4
Australasia.........	....	....	168	....	42	....
Canada.............	....	....	....	8,518	2,130	1.2
Spain..............	....	....	....	869	217	0.1
Dutch East Indies...	....	....	....	568	142	0.1
British West Indies..	....	....	....	10,735	2,684	1.5
Total.........	$166,565	$169,033	$134,847	$238,708[1]	$177,289	100.0

[1] $494 less than amount given in Table 243. Country of origin not given.

Comparing the exports and imports for the years 1913 and 1914, the timber and lumber exported show an increase of 88 per cent in volume and 59 per cent in value, while the value of forest products imported shows a decrease of nearly 10 per cent. At present the exports and imports probably about offset each other, so that the difference, if any, is so slight as not to affect the domestic consumption.

Revenues.—Table 245 shows the revenues received from the sale of forest products, together with the expenses incurred by the Bureau of Forestry from 1901 to 1919:

TABLE 245.—REVENUES AND EXPENDITURES, STATE FORESTS

Year	Revenue	Expense	Surplus	Ratio of expense to revenue
Year ending June 30:				*per cent*
1901–1906	$1,134,296	$ 559,444	$ 574,852	49
1907	95,540	52,525	43,015	55
1908	105,786	53,621	52,165	51
1909	125,690	57,524	68,166	46
1910	135,791	76,080	59,711	56
1911	167,382	80,238	87,144	48
1912	177,342	100,420	76,922	57
1913	195,332	113,524	81,808	58
1913 (July to Dec. 31)	80,456	70,566	9,890	88
Calendar year:				
1914	221,330	128,495	92,835	58
1915	212,908	137,088	75,820	64
1916	247,224	142,854	104,370	58
1917	268,164	140,563	127,601	52
1918	325,346	167,127	158,219	51
1919	402,614	236,621	165,993	59
Total	3,895,201	2,116,690	1,778,511	54

Probable Future.—The probable future of the development of the lumber industry in the Philippines is indicated by its growth from a cut of 6,239,557 cubic feet in 1910 to 17,481,548 cubic feet in 1919. The exports in some of the past 10 years exceeded the imports, and it is only a question of time when the islands will be classified as a permanently exporting country as far as timber is concerned. Red lauan from the Philippines is now underselling California redwood in the Philippines, China, Japan, and Australia. Most of the exports go to the United States, with comparatively large shipments to Hongkong and Shanghai, and smaller amounts to Japan, Indo-China, Australia, and others. China and Australia probably will offer in the near future a much larger market for Philippine woods than heretofore.

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ASIATIC RUSSIA

Asiatic Russia is divided into western Siberia, eastern Siberia, the Siberian prairie region, and Turkestan.

SIBERIA

Forest Area of Siberia.—The forest area of Siberia, exclusive of Turkestan, is estimated at the colossal figure of 1,083,500,000 acres—two and one-half times that of European Russia. Of the total forest area of Russia (1,582,000,000 acres) 71 per cent is in Asia, 27.8 per cent in European Russia, and 1.2 per cent in the Caucasus. The forests of Siberia form 30.5 per cent of the total land area and 75 acres per inhabitant.

The forest area of the different parts of Siberia can be given only approximately. The only forests that have been explored to any extent are the state forests. Since about 96 per cent of the entire forest area of Siberia belongs to the state, statistics of the state forests give a fairly accurate picture of forest conditions of the country as a whole.

By provinces the distribution of the state forests (96 per cent of the entire forest area) is given in Table 246.

Ownership.—Of the total forest area of Siberia, 27,000,000 acres belong to the Cossacks and 18,900,000 to peasants and other private owners. Thus forests in private ownership form only 4.2 per cent of the total, while the bulk, or 95.8 per cent, is either in the exclusive ownership of the government or in joint ownership of the government and local tribes. Very little information is available with regard to the Siberian forests in private ownership. Even of the state-owned forests only 21 per cent has been thoroughly explored.

Character of the Forest.—Lake Baikal divides Siberia into two almost equal parts—western and eastern. Western Siberia includes the provinces of Tobolsk, Tomsk, Yeniseisk, Altai and Irkutsk. Eastern Siberia includes the provinces of Trans-Baikal, Pre-Amur, Amur, Nerchinsk, Yakutsk, Kamchatka, and Saghalien. The prairie region of Siberia includes the provinces of Semipalatinsk, Akmolinsk, Turgai, and Uralsk. The vast stretch of land adjoining the Arctic Ocean from the Ural Mountains to Bering Strait is arctic tundra, devoid of forests, although here and there are found some dwarfed trees. South of it is a forest belt which extends across entire Siberia to the Pacific Ocean. This is the taiga or northern coniferous belt. It is not wholly continuous forest, as is commonly believed, but is interrupted by vast swamps and burns.

The trees are mostly found on divides, particularly on south slopes, where they are protected from the north winds.

Western Siberia.—The most important species in western Siberia are spruce, pine, Siberian fir, "cedar" (*Pinus cembra*), and larch, among the conifers, and birch and aspen among the hardwoods. Along the rivers there are found mixed coniferous and hardwood forests, in which, however, spruce and "cedar" predominate.

Eastern Siberia.—In eastern Siberia, particularly in the Amur and Pre-Amur provinces, another species of spruce (*Picea ajanensis*) is very common. Among other conifers is Manchurian pine (*Pinus mandschurica*), a very valuable tree, *Pinus funebris*, a pine which is particularly plentiful in the basin of the River Ussuri, and larch (*Larix dahurica*). Of the firs are found *Abies nephrolepis*, common in Amur and Pre-Amur, and *Abies holophylla*, common in the southern Ussuri River region.

TABLE 246.—STATE FORESTS, SIBERIA

Provinces and districts	Total area of state forests	Productive area of state forests	Per cent of land under forest	Forest area per inhabitant
Western Siberia:	*acres*	*acres*		*acres*
Tobolsk.	136,985,400	40,709,200	40.0	65.7
Tomsk.	73,190,200	15,812,100	35.0	18.1
Yeniseisk.	80,002,700	42,373,300	12.7	69.9
Irkutsk.	11,034,500	9,985,600	6.1	13.4
Altai.	30,926,900	17,104,700	. . . .	. . . .
Total.	332,139,700	125,984,900	22.1	37.2
Eastern Siberia:				
Trans-Baikal. .	68,800,000	44,435,900	45.1	71.0
Nerchinsk. . . .	22,200,000	16,221,600	. . . .	. . . .
Amur.	88,400,000	58,555,200	89.2	338.0
Pre-Amur Saghalien	399,200,000	208,743,500	79.6	565.0
Yakutsk.	118,800,000	34,570,800	12.1	357.0
Total.	697,400,000	362,527,000	39.0	297.0
Siberian Prairie:				
Semipalatinsk.	3,900,000	2,224,800	3.4	4.5
Akmolinsk. . . .	2,600,000	931,800	1.8	1.7
Uralsk.	79,900	48,600	0.1	0.1
Turgai.	1,434,700	982,700	1.3	2.0
Total.	8,014,600	4,187,900	1.8	2.0

The Hardwood Forests of the Amur Region.—The Amur region presents several distinct forest types. Here the pure coniferous forest of the north mixes with the broadleaf forest, walnut with "cedar," fir and birch with bamboo, and grapevine with spruce. Among the more important hardwood trees, two species of oak predominate—*Quercus mongolica,* which is found along the middle course of the Rivers Amur and Ussuri, and *Quercus grosseserrata,* common in the Ussuri region. The following species are also found: Corkwood (*Phellodendron amurensis*), along the middle course of the River Amur and in the south of the Pre-Amur region; two species of ash, *Fraxinus mandshurica,* over the larger part of the Amur and Pre-Amur territory, and *Fraxinus rhynchophylla,* in the southern Ussuri region; black walnut (*Juglans mandshurica*) in the Amur region and in the central and southern part of the Pre-Amur region; a tree known as *Dimorphanthus mandschurica,* which produces a beautiful veneer; and two species of basswood (*Tilia amurensis* and *Tilia mandshurica*).

The Prairie Region of Siberia.—Spruce is almost entirely lacking in the Siberian prairies, while pine and larch form 82 per cent of the forest. The hardwoods characteristic of the prairie region east of the Ural Mountains are chiefly birch, with an occasional admixture of willow and aspen. Neither oak, maple, ash, elm, nor basswood are found in the prairies east of the Ural Mountains until the Amur region is reached.

Table 247 shows the distribution by species of the productive area of state forests in the provinces of Siberia.

Conifers occupy 77.6 per cent of the total forest area in western Siberia, 66.5 per cent in eastern Siberia, and 82.2 per cent in the Siberian prairie region.

Annual Growth, Cut, and Consumption.—The annual cut in 1913, the last normal year before the war, was 244 million cubic feet. With a population of 14,395,000 this represented 17 cubic feet per capita and 0.5 cubic foot per acre of productive state forest area. This is not the whole cut. The latter is difficult to determine because in a large part of the government forests cutting is free and without supervision. Whatever other cutting there may be, however, is chiefly for firewood and local use. With a small population the aggregate amount can not be very much.

The possible cut in the productive area of all state forests based on annual growth is estimated at 10,786,000,000 cubic feet. The amount of timber designated for cutting is 1,288,000,000 cubic feet. The actual cut is thus 19 per cent of the designated cut, and only 2.3 per cent of the possible cut, while the designated cut is only 11.9 per cent of the possible cut. Since the outbreak of the war the population of Siberia has greatly increased. An estimate of one billion cubic feet for the cut now would be none too extravagant. Assuming that the per capita consumption in Siberia is only as much as European Russia, namely 66 cubic feet per capita, then the total cut in Siberia must be in the neighborhood of 950 million cubic feet, of which 45 per cent is probably firewood. About 10 billion cubic feet annually therefore remains unutilized. Even if the possible cut from the jointly owned forests is excluded, 6 billion cubic feet still remains as unutilized timber in the state forests. The annual growth per acre over the productive area of state forests may be taken at 21.9 cubic feet, and for the entire forest area, 10 cubic feet.

Although for Siberia as a whole the cut falls far below the growth, the prairie provinces of Akmolinsk and Semipalatinsk are already being heavily cut over. The few forests in the prairie belonging to the peasants, Cossacks, and other private owners are greatly depleted and in some places entirely destroyed. It falls therefore upon the state forests to supply timber for the local population. In the province of Akmolinsk the actual cut was twice the possible cut, as indicated by the annual growth, and in some districts the cut was three times as large. In the

TABLE 247.—DISTRIBUTION OF SPECIES, SIBERIA

Province	Pine	Cembran pine (cedar) and larch	Spruce and fir	Oak, ash, and elm	Birch, aspen, and poplar	Total
Western Siberia:	*acres*	*acres*	*acres*	*acres*	*acres*	*acres*
Tobolsk	19,525,400	5,717,100	5,584,200	...	9,882,500	40,709,200
Tomsk	3,189,600	1,624,200	4,910,600	...	6,087,700	15,812,100
Yeniseisk	6,802,100	4,534,800	13,809,000	...	3,870,500	29,016,400
	2,003,500	1,335,700	6,010,600	...	4,007,100	13,356,900
Irkutsk	6,123,400	1,339,200	1,743,600	...	779,400	9,985,600
Altai	2,530,400	3,040,800	7,909,400	...	3,624,100	17,104,700
Total	40,174,400	17,591,800	39,967,400	...	28,251,300	125,984,900
Per cent	31.9	14.0	31.7	...	22.4	100.0
Eastern Siberia:						
Trans-Baikal	19,067,200	7,463,400	8,702,700	...	2,524,100	37,757,400
	2,337,500	2,337,500	1,536,000	...	467,500	6,678,500
Nerchinsk	6,237,000	5,103,000	3,701,700	...	1,179,900	16,221,600
Amur	14,026,300	9,395,800	9,296,300	5,342,500	20,494,300	58,555,200
Pre-Amur	800	18,646,200	13,710,600	11,518,500	10,967,400	54,843,500
Saghalien	1,900	53,863,100	46,170,000	...	53,865,000	153,900,000
Yakutsk	7,649,000	5,099,300	6,914,200	...	14,908,300	34,570,800
Total	49,319,700	101,908,300	90,031,500	16,861,000	104,406,500	362,527,000
Per cent	13.6	28.1	24.8	4.7	28.8	100.0
Siberian Prairie:						
Akmolinsk	500,900	...	...	...	430,900	931,800
Semipalatinsk	1,410,200	681,700	2,900	...	130,000	2,224,800
Total	1,911,100	681,700	2,900	...	560,900	3,156,600
Per cent	60.5	21.6	0.1	...	17.8	100.0

province of Semipalatinsk the cut was nearly equal to the annual growth. The cut per capita in Akmolinsk was 13 cubic feet a year and in Semipalatinsk 22 cubic feet. This is a very low consumption, especially when wood must serve as a source not only of building material but also of fuel. In spite of the scarcity of timber in the Siberian prairie region the revenue from the forest is ridiculously small. The net revenue per acre in Akmolinsk is three cents and in Semipalatinsk 1.2 cents, or an average for the two provinces of 1.7 cents. On the other hand, in such provinces as Yakutsk, where the growth is over 776 million cubic feet, no timber is being cut at all, while in the rest of the provinces the actual cut ranges from 0.3 of 1 per cent to 12 per cent of the possible cut or annual growth.

In Table 248 are given the annual growth, the designated cut, and the actual cut in 1913 by provinces, for all state forests. In Table 249 is given the possible annual cut, by species, from forests under exclusive control of the government, and from those owned jointly.

The export of timber to foreign markets from Amur and Pre-Amur provinces amounted before the war to about 2 million cubic feet a year. The per capita domestic consumption, as far as the official statistics indicate, is probably 16.8 cubic feet. The actual domestic con-

TABLE 248—ANNUAL GROWTH, DESIGNATED CUT, AND ACTUAL CUT, 1913

Province	Annual growth	Amount of timber designated for cutting		Actual cut		
		Live timber	Per cent of annual growth	Live and dead timber	Per cent of annual growth	Per cent of designated cut
Siberian prairie region:	*cu. ft.*	*cu. ft.*		*cu. ft.*		
Akmolinsk	12,123,540	14,758,700	121.7	20,331,740	167.7	137.8
Semipalatinsk	23,472,460	38,203,440	162.8	19,571,200	83.4	51.2
Western Siberia:						
Tobolsk	896,363,820	146,259,520	16.3	40,751,700	4.5	27.9
Tomsk	436,796,580	181,464,360	41.5	16,971,900	3.9	9.4
Altai	455,380,420	179,080,000	39.3	55,440,000	12.2	31.0
Yeniseisk	905,650,680	211,713,700	23.4	14,497,560	1.6	6.8
Irkutsk	208,702,560	131,798,040	63.2	9,803,200	4.7	7.4
Eastern Siberia:						
Trans-Baikal	925,488,960	149,771,600	16.2	18,425,000	2.0	12.3
Nerchensk	338,085,000	32,000,000	9.5	16,356,000	4.8	51.1
Amur	1,278,938,760	39,404,860	3.1	17,016,780	1.3	43.2
Pre-Amur, Saghalien, and Kamchatka	4,528,280,108	163,860,400	3.6	15,097,720	0.3	9.2
Yakutsk	776,695,160	....	0.0	....	0.0	0.0
Total	10,785,978,048	1,288,314,620	11.9	244,262,800	2.3	19.0

TABLE 249.—POSSIBLE ANNUAL CUT, BY SPECIES

Province	Pine	Cembran pine (cedar) and larch	Spruce and fir	Oak, ash, and elm	Birch, aspen, and poplar	Total
State forests under exclusive control of the government						
Siberian prairie region:	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Akmolinsk	5,102,020				7,021,520	12,123,540
Semipalatinsk	14,362,700	6,942,980	47,740		2,119,040	23,472,460
Western Siberia:						
Tobolsk	397,740,200	116,458,980	113,752,760		268,411,880	896,363,820
Tomsk	86,632,260	44,114,620	120,035,740		186,013,960	436,796,580
Altai	68,713,260	82,590,640	193,339,520		110,737,000	455,380,420
Yeniseisk	138,562,160	92,374,920	281,293,980		105,126,120	617,357,180
Irkutsk	124,735,160	27,280,440	35,518,780		21,168,180	208,702,560
Eastern Siberia:						
Trans-Baikal	388,406,700	152,032,980	177,276,440		68,556,180	786,272,300
Nerchensk	127,050,000	103,950,000	75,405,000		31,680,000	338,085,000
Amur	253,973,500	170,130,400	189,368,960	108,829,380	556,636,520	1,278,938,760
Pre-Amur Saghalien and Kamchatka	14,652	337,626,652	279,290,000	234,635,500	297,880,000	1,149,446,804
Total	1,605,292,612	1,133,502,612	1,465,328,920	343,464,880	1,655,350,400	6,202,939,424

THBLE 249.—POSSIBLE ANNUAL CUT, BY SPECIES—*Continued*

Province	Pine	Cembran pine (cedar) and larch	Spruce and fir	Oak, ash, and elm	Birch, aspen, and poplar	Total
State forests in joint ownership in which cutting is permitted						
	cu. ft.	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*	*cu. ft.*
Yeniseisk	40,812,640	27,208,500	111,438,360	....	108,834,000	288,293,500
Trans-Baikal	47,614,820	47,614,820	31,289,720	....	12,697,300	139,216,660
Pre-Amur Saghalien and Kamchatka	34,210	975,299,094	940,500,000	....	1,463,000,000	3,378,833,304
Yakutsk	138,600,340	92,333,560	140,844,000	....	404,917,260	776,695,160
Total	227,062,010	1,142,455,974	1,224,072,080	....	1,989,448,560	4,583,038,624
Grand total	1,832,354,622	2,275,958,586	2,689,401,000	343,464,880	3,644,798,960	10,785,978,048

sumption, however, must be at least 70 cubic feet per capita. The annual growth thus is far in excess of the present cut or consumption. When her resources are developed, Siberia can make available about 6 billion cubic feet for export and at the same time increase the domestic consumption to about 5 billion cubic feet without depleting her forests. The amount of timber which can be made available for export trade is distributed geographically about as follows: from the forests of the Far East tributary to the Pacific Ocean there may be obtained about 4,600,000,000 cubic feet; from the forests of the Yeniseisk River basin about 500,000,000 cubic feet; and from the forests of the Ob River basin about 650,000,000 cubic feet. If we consider that the export of timber from all countries is equal to about 3¾ billion cubic feet a year, the amount of timber that Siberia can furnish to the markets of the world, without depleting her own forests, is truly enormous.

Assuming that 25 per cent of this timber available for export is large sawlog timber, 25 per cent small structural timber, and 50 per cent firewood and pulpwood, and allowing 10 cents per cubic foot on the stump for the large sawlog timber, 5 cents for the small structural timber, and 1 cent for firewood, the revenue which Siberia could derive from the state forests would amount to about $255,000,000, for export timber alone.

The utilization of the forests of Asiatic Russia has hardly begun. Because of lack of convenient transportation the vast forest region of the government of Tobolsk and the provinces of Trans-Baikal and Yakutsk will for a long time remain inaccessible for export trade. Only recently the forests of the governments of Tobolsk and Tomsk, which are near railroads, have begun to be exploited and the product shipped through Petrograd or Archangel to western Europe. A product which can justify its transportation abroad, however, must be of the highest grade, since it alone can stand the expensive freight charges.

Only the forests of the Far East are favorably situated for foreign export, because of the facilities for transportation offered by the River Amur and other rivers flowing into the Pacific Ocean. There is already a fairly extensive local lumber industry which exports timber from several ports on the coast of the Pacific Ocean. Thus, in 1910, there was exported from Vladivostok 7,200 tons of forest products, and in 1911 this export was increased to 17,000 tons. Although the timber is generally exported to Japan and China, the higher grades have gone to western Europe, particularly Great Britain. In addition, there has been exported to Australia from the Bay of Terney about 110,000 cubic feet of spruce and "cedar" (*Pinus cembra*) timber, and from the Bay of St. Olga 374,000 cubic feet of mine props. In 1911 there was begun an export trade (about 100,000 cubic feet) from the port of Posiet. The export trade from Posiet started when several lumbermen organized the manufacture of timber and shipment into Australia and China. China undoubtedly offers a very large market for Russian timber. According to the Russian authorities, in 1911 China imported about $8,000,000 worth of timber products from Japan and the United States. The chief requirement of the Chinese market is cheapness. It could therefore be satisfied with second-grade material made up from defective timber or even tops. This would be of considerable advantage in the proper management of the Russian forests since they, like those in the United States, suffer chiefly from lack of markets for the lower grades.

There were before the war, in the provinces of Amur and Pre-Amur and on the Island of Saghalien, about 40 private sawmills and 3 government sawmills, which worked chiefly for local markets.

TURKESTAN

Extent of Forests.—The extent of the forests within this region is shown in the following table:

TABLE 250.—FOREST AREAS, TURKESTAN

District	Total area of state forests	Productive forest area
	acres	*acres*
Semirechensk	3,445,727	3,445,727
Sir-Daria	23,050,664	17,996,351
Samarkand	10,567,484	7,672,001
Ferghana	2,593,779	1,609,880
Total	39,657,654	30,723,959

This is 14.7 per cent of the land area and 5.9 acres per capita.

The Vertical Forest Belts of Turkestan.—In Turkestan there may be distinguished five altitudinal vegetation belts, beginning with the lowest:

a. *The alkali belt.* This is characterized by large stretches of *Haloxylon ammodendron,* a shrub not unlike our mesquite, with poplar (*Populus diversifolia*) along the rivers.

b. *The cultivated belt.* This comprises the most fertile loess soil, requiring only water to give wonderful crops; much of it is already under cultivation. Its upper limit is at from 2,000 to 2,500 feet.

c. *The broadleaf belt.* This does not extend above 8,500 feet. Birch and several species of poplar are present. Other species are black walnut (*Juglans regia*), cherry, wild apple, and pistachio, with some ash and maple.

d. *The coniferous belt.* This is chiefly made up of spruce (*Picea schrenkiana*). The upper limit varies from 7,500 to 10,000 feet. Above it is found juniper.

e. *The belt of alpine vegetation.*

Character of the Forest.—Broadleaf species predominate—birch, aspen, alder, black and white poplar, elm, oak, and maple. Spruce and pine are found only in isolated places in the mountains. At the foot of the mountains of Turkestan walnut is quite common.

The forests of Turkestan are hardly touched as yet, because of lack of water and railroad transportation. The only product so far exported on a large scale is black walnut burls. These burls, which yield a very finely figured veneer, successfully stand distant transportation. Recently, however, because of reduced demand for this type of veneer, the trade has become less profitable.

Probable Future.—The forest situation in both European and Asiatic Russia may be briefly summarized as follows:

TABLE 251—SUMMARY OF THE FOREST SITUATION IN RUSSIA

Region	Forest area	Ratio to land area	Forest area per capita	Annual cut	Annual growth	Excess of exports over imports	Domestic consumption	
							Total	Per capita
	M acres	*per cent*	*acres*	*M cu. ft.*	*M cu. ft.*	*M cu. ft.*	*cu. ft.*	*cu. ft.*
European Russia	440,000	38.7	4.4	7,000,000	12,711,000	400,000	6,600,000	66.0
Caucasus	18,500	15.9	1.4	250,000	500,000	1,325	248,675	18.8
Siberia	1,083,500[1]	30.5	75.3	1,000,000	10,786,000[4]	2,000	998,000	69.3
Western	332,200[2]	22.1	37.2	....	2,903,000	....	....	....
Eastern	697,400[2]	39.0	297.0	....	7,8407,00	2,000	....	....
Prairie region	8,000[2]	1.8	2.0	....	306,00	....	....	....
Turkestan[3]	40,000	14.7	5.9	100,000	100,000[4]	....	100,000	15.0
Total	1,582,000	31.2	11.8	8,350,000	24,097,000	403,325	7,946,675	59.2

[1] Includes 27,000,000 acres belonging to the Cossacks and 18,900,000 belonging to peasants.

[2] State forest area.

[3] Exclusive of the Trans-Caspian Province.

[4] Possible, not actual growth.

Russia possesses the largest forest area of the world, containing the most valuable species used by the industries of the civilized world. That the export of timber is capable of great increase is shown in Table 252.

TABLE 252—EXPORTS AND FOREST AREAS

Country	Forest area	Export of timber
Russia	1,582,000,000	$ 89,250,000
United States	469,000,000	134,437,000
Norway and Sweden	72,000,000	129,489,000
Former Austria-Hungary	53,000,000	79,203,000

How steadily timber export is growing and what an increasingly important part it assumes in Russia's trade balance may be judged from her export of timber to England for the period ending 1913, as compared with Scandinavia and the United States (in per cent of the entire import of England):

Country	1903	1907	1909	1911	1913
	per cent	*per cent*	*per cent*	*per cent*	*per cent*
Russia	29	37	46	47	51
Norway and Sweden	23	32	25	25	25
United States	33	28	27	26	22

During the war a great change took place in the timber export of Russia, which will become permanent. Sixteen million acres adjoining the Baltic provinces which supplied the bulk of export timber were in the fighting zone and were ruined. The regions from which the export timber will now come are the north and northeastern forest regions, and Archangel will become the chief source of export.

The forest resources of Russia, especially of northern and northeastern Russia, are of the utmost importance to Great Britain, France, and Belgium, which are exceedingly heavy consumers of Russian sawn lumber and other manufactured forest products. German lumber industry, on the other hand, is almost entirely built on Russian raw material, the manufactured products of which as, for instance, paper, are later reexported to Russia. According to Russian statistics, before the war Russia occupied first place among the timber-exporting countries in the actual amount of wood exported. It was second in importance only to the United States and Canada combined in regard to the value of the product exported. The following figures evidently do not include exports of wood in all forms.

Country	Proportion of total world exports	
	Quantity	Value
	per cent	*per cent*
From Russia	29.3	23.3
From Finland	18.6	11.5
Total from Russia	47.9	34.8
From United States of America	18.8	31.2
From Canada		
From Sweden	17.7	18.5
From Norway		
From former Austria-Hungary	15.6	15.5
Total from other countries	52.1	65.2
Total export	100.0	100.0

Of the various forest regions of Russia, those of northern European Russia are the most valuable and economical for construction purposes and will play the greatest part in export trade. The timber in the forests of European Russia south of the 60th parallel will be used chiefly by the local population, while the forests of the Archangel and Vologda regions will yield a vast quantity of timber for export. These two northern provinces have 55 sawmills, the yearly output of which is 10 million beams. The northern provinces can be further developed even without additional railway facilities, because the whole of northern European Russia has excellent water communications. The forests of Asiatic Russia, except the most eastern provinces, although capable of enormous export trade amounting to about 6 billion cubic feet a year, must wait until a network of railroads running in all directions is developed. Russia's forest resources are bound to play an important part in her financial and economic rehabilitation. The development of the timber industry and the export of Russian timber to the European market means the practical solution of many of her financial difficulties. The development of the timber industry will create a favorable foreign trade balance and may assist in the payment of the national debt. No other resource of Russia will be so easy to convert into cash as her timber.

References

"The Forest Resources of the Far Eastern Republic." Published by the Special Delegation of the Far Eastern Republic to the United States of America, Washington, D. C. 1922.

The Russian Far East Economic Monthly (in Russian). No. 4, January, 1921. K. Lavrov, Editor. Tokyo.

See also references for Russia.

SIAM

Extent and Character of Forests.—The Kingdom of Siam has a total area of about 155,520,000 acres (243,000 square miles), and a population of over 8,800,000. It is estimated that approximately 22½ per cent of the area, or 35 million acres, is covered with forest. The present merchantable forests, which are almost exclusively teak, occupy an area of only about 4 million acres. The teak forests are situated in the northern part of the kingdom, and cover the area extending from the northern boundary between Siam and Tennesserim, or from latitude 17½° to 20° N., and from longitude 97¾° to 101¾° E., comprising 3,840,000 acres (6,000 square miles). There is also a small strip along the Burmese frontier on the west extending from latitude 15½° to 17½° N., thus joining the above forest on the south. This strip comprises 230,400 acres (300 square miles). Thus the total area of teak forests in Siam would be about 4 million acres (6,360 square miles). There is no teak east of the Mekong River. The forests of the south are mostly tropical mixed forests with many valuable species, including rosewood, boxwood, agilla, and sapan wood. The per capita area of teak forest is thus about 0.45 acre, and that of all the forests 4.0 acres.

Ownership.—There is no land in Siam on which the forests are privately owned. About three per cent of the land is under registered private ownership, and about five per cent is under unregistered private ownership, the remainder belonging to the crown. But even in the case of the land privately owned, all mineral and timber rights are expressly reserved to the crown, which may grant concessions for their exploitation under due control but never cedes the ownership.

Up to within the last few years no effort was made to preserve even the teak forests, and they were cut indiscriminately. There is now a forest department that is looking to their preservation. This department controls the cutting of teak very carefully, but is somewhat less strict in regard to other timber.

Annual Cut, Growth, and Consumption.—The annual cut of teak depends upon the rainfall, which influences the high water of the streams. Logging is done in the northern districts, and the logs are driven down stream to Bangkok and some go east to Indo-China. On the average about 120,000 logs per year are taken out, roughly 2,750,000 cubic feet, of which about one-half is of first quality. The cut per acre is 0.68 cubic foot, a rather small cut. The greater part of the teak is cut by seven Bangkok concerns—4 British, 1 Danish, and 2 Chinese. There are in all about 11 sawmills at Bangkok, while a number of native or Chinese yards scattered around the country whipsaw lumber by hand. The forests in southern Siam are just now beginning to be exploited. Several foreign concerns have obtained concessions in southern Siam, and are supplying the cheap wood for local uses which has heretofore been imported by way of Singapore. The cut of all kinds of timber, including firewood, is estimated at approximately 48,458,000 cubic feet. Of this, 44,000,000 cubic feet is consumed within the country, about 85 per cent of it being firewood. The growth of timber is probably at least equal to the annual cut, which amounts to an average of only 1.4 cubic feet per acre.

Exports and Imports.—Next to rice, teak is the most important article of export from Siam. In the year ending March 31, 1911, exports of this wood amounted to 4,458,250 cubic feet, valued at $2,820,914, and distributed as given in Table 253.

TABLE 253.—DISTRIBUTION OF TEAK EXPORTS

Country	Cu. ft.	Country	Cu. ft.
British India	2,124,350	China	93,650
United Kingdom	579,550	Italy	88,600
Hongkong	470,250	Germany	59,200
Ceylon	344,050	Others	277,450
France	184,750		
Japan	142,700		
Singapore	93,700	Total	4,458,250

Exports of all other woods for the same year were valued at $213,217. These went to the United Kingdom, Hongkong, and Singapore.

Imports, chiefly of cheap woods for construction and the like, amounted to $319,431.

References

U. S. Daily Consular Report, May 18, 1912.

Map of the Kingdom of Siam and Its Dependencies, constructed from Siamese Government Surveys under direction of J. McCarthy, F. R. G. S., Supt. of Surveys. (Submitted by R. M. Boyd, Consul to Siam).

TURKEY

Turkey originally included: (1) Turkey in Europe; (2) Turkey in Asia (Anatolia, Arabia, Syria, Palestine, Mesopotamia, and Kurdistan); and (3) certain islands in the Mediterranean. Since the conclusion of the first Balkan war (1913) and the treaty of peace in 1920, the Turkish empire was practically reduced to possessions in Anatolia (Asia Minor).

Even there Smyrna with the surrounding strip of country was to be administered by Greece, under Turkish sovereignty. In 1922, however, Turkey recovered Smyrna, and may eventually get part of Thrace.

The area of new Turkey, including Smyrna but not Thrace or Constantinople, is now 127,534,000 acres, and the population is 10,187,000. Should Turkey lose Smyrna, its area will be further reduced to 111,000,000 acres and the population to about 8,000,000. New Turkey is made up of the following provinces or vilayets:

Table 254.—Area and Population, New Turkey

Province or vilayet	Area	Population	Province or vilayet	Area	Population
	acres			*acres*	
Ismid ("Independent" Sanjak)...	2,003,200	222,700	Angora.....	17,516,800	932,800
Brusa	16,256,000	1,626,800	Konia......	25,222,400	1,069,000
Bigha ("Independent" Sanjak)...	1,632,000	129,500	Adana.....	9,856,000	422,400
Smyrna, or Aidin..	16,512,600	2,500,000	Sivas......	15,340,800	1,057,500
Kastamuni.......	12,524,800	961,200	Trebizond..	10,669,400	1,265,000
			Total...	127,534,000	10,186,900

The total forest area of present Turkey is in the neighborhood of 17,000,000 acres, distributed among the different vilayets as follows:

Table 255.—Forest Area, New Turkey

Province or vilayet	Forest area (acres)	Per cent of land under forest	Province or vilayet	Forest area (acres)	Per cent of land under forest
Ismid ("Independent" Sanjak)..	825,000	41.2	Angora..........	533,000	3.0
Brusa	5,681,000[1]	34.9	Konia...........	900,000[1]	3.6
Bigha, ("Independent" Sanjak)..	494,000[1]	30.3	Adana..........	1,039,000	10.5
Smyrna, or Aidin..	1,482,000[1]	9.0	Sivas...........	767,000	5.0
Kastmuni........	4,175,000[1]	33.3	Trebizond.......	1,225,000	11.5
			Total.....	17,121,000	13.4

[1] From Handbook published by British Foreign Office, London, 1920.

The forests thus occupy 13.4 per cent of the total land area and constitute 1.68 acres per capita.

Although the area under forest forms but a small percentage of the total land area and Turkey as a whole may be considered as deficient in forests, it is by no means such a treeless country as is generally supposed. Its per capita forest area would indicate that it has sufficient forest not only for its own use but should have timber for export. The great difficulty in Turkey is that the forests are unevenly distributed; while some vilayets like Ismid, Brusa, and others, are very well wooded, in others less than 5 per cent of the area is under forest. Particularly along the Black Sea in Pontus and Paphlagonia and also on the southern slopes of the Cilician Taurus magnificent forests may still be found. The cedars of the Cilician Taurus to the north of the Adana supplied the markets of Rome in the days of Cleopatra and up to recent times, and a remnant of their former splendor still exists. Turkey is one of the classical examples of a country in which, with the destruction of the forest, its mitigating influence upon unfavorable climatic conditions has also been destroyed, turning the country in many places into an unproductive waste.

Character of the Forest.—The forests of Turkey consist of several kinds of pine, larch, fir, several species of oaks, chestnut, beech, basswood, sycamore, elm, poplar, and alder.

Character of Ownership.—The state owns 88.03 per cent of the forests, 1.23 per cent belongs to religious bodies, 1.66 per cent to the communes, 6.13 per cent is privately owned, and 2.95 per cent is undetermined. Although the greater part of the forests are the property of the state, the ancient rights of usage for grazing are recognized. This is a prolific source of destruction of the young growth. In many cases the herdsmen cut down promising young trees to feed the leaves to their flocks.

Annual Growth, Cut, and Consumption.—No figures are available as to actual growth, cut, and domestic consumption. There is no doubt that the forests are being destroyed much faster than they are growing. Unrestricted grazing, especially of goats, and fires are the chief sources of destruction. When the peasants require a little cleared land they set fire to the forests and destroy square miles instead of acres. Over 76 per cent of the whole product of the forests, valued at $5,976,150, is used at home and 24 per cent exported. Egypt, France, and Greece receive most of the export, which consists of elm, fir, pine, beech, oak, and cedar. Considerable amounts of lumber, however, are imported into Turkey through Constantinople, which is both a point of consumption and a transshipment point for Mudania, Brusa, Ismid, and other provincial towns of the Ottoman empire located along the Anatolian Railroad in Asia Minor. Thus in 1911 and 1912 the total wood import to Turkey amounted to close to five million dollars. In value the imports exceeded several times the value of exports. On the whole, therefore, Turkey must be considered a wood-importing country. The domestic consumption may be assumed to be about 15 cubic feet per capita, or a total of 150 million cubic feet per year.

Forest Laws.—Turkey, like Spain, France, and Italy, has suffered to a marked degree from reckless and wholesale destruction of mountain forests. Conservation of forests was not seriously considered until about 50 years ago. A forest law, passed in 1870, and slightly modified from time to time, brought about a partial improvement in the working of the forest administration; all forests were placed under the agents of the Department of State; the right of naval and military departments of the state to appropriate timber from the state forests was withdrawn. A more recent law provides for the systematic cutting of wood under the direct supervision of inspectors, assisted by a regular staff, whose duties are to regulate the quantity felled for export and local consumption and supervise the operations of charcoal burners. The law also provides for collection of dues and fines. In theory the new law is satisfactory, but in practice it has not improved the development of forestry to any great extent, because of negligence on the part of local authorities and lack of roads. The forest laws of the Island of Samos resemble those of Turkey proper, but are distinct.

The usual method of working the forests is as follows:

The peasant is granted a cutting permit by the keeper, after which he may cut such trees as have been marked by the inspector and haul the wood to the nearest market. Here he shows his permit and pays the tax before selling the wood. This formula is not always insisted on, on account of laxity of the officials.

The Probable Future.—With the extension of the Anatolian and Bagdad railway lines, Asiatic Turkey is likely to become a very active participant in the wood industry and trade. The country is certain to be accessible in the near future for European woods, an important circumstance for Mesopotamia, which is poor in timber. But the mountain regions of Asia Minor contain fairly large stands of coniferous timber (*Pinus orientalis*, *Cedrus*, *Abies*), and of beech, oak, chestnut, elm, and walnut, offering a good foundation for a thriving timber trade. Of course the transportation question will have to be solved before the native timber industry can be developed. The regions to the south and west will be open as a market for these future enterprises, but the present modest export of small building timber and fuelwood to Egypt and the Aegean islands is also capable of expansion and development.

The forests of the Taurus, Anti-Taurus, and Amanus mountains in the province of Adana, although they are limited in extent, are exceedingly valuable. They are conveniently located with reference to markets; the quality of the timber is excellent; water power for working sawmills is practically unlimited; and the large rivers, in which the flow of water is permanent and uniform, are available for transport of lumber to the sea or to the railways, at low prices. The total area of so-called forest land is about four million acres, but the area actually producing commercial timber is a little less than one million acres. The species occurring in greatest quantity are pine, five varieties, 40 per cent; oak, 3 varieties, 17 per cent; white cedar, 10 per cent. The remainder is made up of a large number of species in small proportion, among them spruce, olive, birch, beech, mulberry, holly, walnut, willow, poplar, and others. White pine is the most valuable tree in the province—a large, symmetrical tree furnishing fine, easily worked, durable wood. Black pine is used for ties and roof timbers, white cedar for cabinet work, and the spruces for paper pulp. The total amount of commercial timber in the forests of this province is about 1,750 million cubic feet.

The forests in the provinces along the Black Sea are also of considerable importance, though up to this time they have been worked only on a small scale and with very primitive methods. If modern machinery and scientific methods of conservation were introduced, the lumber industry of Anatolia would grow to fairly large proportions. Cheap labor, abundant water power, and adequate transportation routes to the sea coast are items in favor of the development of this resource.

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